

**NUMBER 84**

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# **THE BULLETIN**

**OF THE**

## **U. S. Army Medical Department**

**A periodical containing original articles, reviews, news, and  
abstracts of interest to the Medical Department of the Army**

**ISSUED UNDER THE AUSPICES OF  
THE OFFICE OF THE SURGEON GENERAL**

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**PUBLISHED MONTHLY AT THE MEDICAL FIELD SERVICE SCHOOL,  
CARLISLE BARRACKS, PENNSYLVANIA**



By direction of the Secretary of War, the material contained herein is published as administrative information for the proper transaction of the public business and with the approval of the Director of the Budget.

NORMAN T. KIRK  
Major General, U. S. Army,  
The Surgeon General.

NUMBER 84

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**WAR DEPARTMENT**  
**OFFICE OF THE SURGEON GENERAL,**  
**WASHINGTON 25, D. C.**

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## **U. S. Army Medical Department**

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School, Carlisle Barracks, Pennsylvania.

Annual subscription : \$2.00 ; foreign subscription : \$2.50.  
Single copies, domestic, 25 cents ; foreign, 30 cents.

All other communications relating to this publication should be addressed  
to The Surgeon General, U. S. Army, Washington 25, D. C.



## Foreword

With the October 1943 issue, The Bulletin became a monthly periodical, instead of a quarterly, dedicated to keeping the personnel of the Medical Department informed on developments in war medicine. The new publication, known as The Bulletin of the U. S. Army Medical Department, absorbed the former quarterly dental and veterinary bulletins and will have material devoted to those fields in each issue.

The Bulletin is intended to be educational rather than directive in nature. It will contain the best information obtainable concerning military medical experience, observations, and procedure that may help to improve further the quality of professional services. The Bulletin will be a medium whereby experience gained in one theater of combat may be shared with those serving in other combat areas and with those in this country who are preparing for overseas duty. News items concerning military and scientific developments as well as original articles will be emphasized. The Bulletin, however, should not serve as a basis for the forwarding of requisitions for equipment or supplies referred to therein.

Obviously, some of the most interesting field experiences cannot be divulged in a periodical of this kind when our country is at war. The Bulletin will, however, publish that which can be safely told, drawing not only on current literature, but on many authoritative reports which reach The Surgeon General's Office from the field. Officers are invited to submit for publication reports of their field experiences that can profitably be shared with other officers.

The Medical Department has been commended for its work in caring for the sick and wounded in theaters of operations in war. The Bulletin will endeavor to stimulate such progress and to advance further the high standard of medical service in the Army of the United States.

# Contents

## NEWS AND COMMENT

	<i>Page</i>
The Control of Dengue on Saipan .....	1
Uses and Operation of a Field Hospital .....	2
On the Double .....	4
Nutrition and Recovery from Injury and Disease .....	5
Pulmonary Damage Caused by FS Smoke .....	6
Arm Splint Improvised from Ammunition Container .....	7
Trombone Traction Leg Splint with Shoe Clamp .....	8
Replacement of Tincture of Green Soap .....	10
Study of Paradichlorobenzene in Fly Control .....	12
Graduate Education for Physician Veterans .....	14
Annual Meeting of Military Surgeons .....	16
Pneumatic Pants for Fighter Pilots .....	17
Procedure for Shoe Fitting .....	18
The Medical Nutrition Laboratory .....	18
Lyster Bag Coverings .....	20
Scrub Typhus Not a Cause of Chronic Heart Disease .....	21
Plans of the Council on Dental Health .....	22
Medical Department Training Films .....	24
Gas Masks for Patients with Head Wounds .....	26
Sanitary Cover for Meat Blocks .....	27
Monthly Medical Meeting .....	27
An Improvised Slit Lamp .....	28
The Dedication of Wakeman Field .....	30
Largest Class at Carlisle Barracks .....	31
Suction Apparatus .....	32
Retinal Detachment Apparatus .....	33
Generator Screen for Lantern and Gasoline Stove Burners .....	34
The Salmon Lectures .....	34
Postwar Plans for the Medical Department .....	35
The Lasker Award in Mental Hygiene .....	35
Award of Distinguished Service Medal .....	37
Award of Oak-Leaf Cluster .....	37
Recent Directives and Publications .....	38
Army Medical Museum Seminars .....	57
Viruses .....	73
Shock .....	89
Second Hospital for Prisoners of War .....	93



## SPECIAL ARTICLES

THE EPIDEMIOLOGY OF EPIDEMIC HEPATITIS	
Major Guy H. Gowen, M.C., A. U. S. ....	41
TOTAQUINE IN THE TREATMENT OF MALARIA	
Captain Robert A. Green, M.C., A. U. S. ....	51
SURGICAL MANAGEMENT OF WOUNDED IN MEDITERRANEAN THEATER AT THE TIME OF THE FALL OF ROME	
Colonel Edward D. Churchill, M. C., A. U. S. ....	58

## ORIGINAL ARTICLES

SUPPLY OF PRESERVED BLOOD TO EUROPEAN THEATER OF OPERATIONS	
Lieut. Colonel Douglas B. Kendrick, Jr., M.C., U. S. A., Captain John Elliott, Sn.C., A. U. S., Captain John Reichel, Jr., M.C., A. U. S., and Captain Ellis K. Vaubel, M.C., A. U. S. ....	66
EFFECT OF MALARIA ON SEROLOGIC TESTS FOR SYPHILIS	
First Lieut. Arthur A. Rosenberg, Sn.C., A. U. S. ....	74
CONVULSIONS DURING INHALATION ANESTHESIA	
Captain E. M. Papper, M.C., A. U. S. ....	81
PHYSICAL MEDICINE IN AN EVACUATION HOSPITAL	
Lieut. Colonel Willis M. Weeden, M.C., A. U. S., and Captain Hymen D. Stein, M.C., A. U. S. ....	85
CLEFT PALATE PROSTHESIS	
Captain Murray L. Schole, D.C., A. U. S., and Captain Theodore Katz, D.C., A. U. S. ....	90
SPONTANEOUS HEMOPNEUMOTHORAX	
Captain Stephen B. Payn, M.C., A. U. S., and Major Victor F. Lief, M.C., A. U. S. ....	94
PREVENTION OF ANGULATION IN LOWER THIRD HUMERAL FRACTURES	
Major Robert P. Kelly, M.C., A. U. S., and Captain James W. Riley, M.C., A. U. S. ....	100
DEMONSTRATION OF HIDDEN APICAL CHEST LESIONS	
Captain H. E. Bass, M.C., A. U. S., and Major Samuel I. Kooper- stein, M.C., A. U. S. ....	102
ARTERIOVENOUS ANEURYSM	
Lieut. Colonel Daniel C. Elkin, M.C., A. U. S. ....	104
THE COLLECTING COMPANY IN COMBAT ON PACIFIC ATOLLS	
Captain Daniel M. Adams, M.C., A. U. S. ....	106

## CLINICAL NOTES

THE CARE OF SOLDIERS' FEET	
Captain Paul A. Pemberton, M.C., A. U. S. ....	110
BRONCHIAL ASTHMA DUE TO SULFATHIAZOLE	
Captain Philip E. Zanfagna, M.C., A. U. S. ....	117
MODIFIED MAXILLARY FRACTURE SPLINT	
Captain Samuel Blausten, D.C., A. U. S. ....	119
TRAUMATIC NEUROPATHY OF BRACHIAL PLEXUS IN PARATROOPERS	
Captain Victor H. Rosen, M.C., A. U. S. ....	121

## Greetings to All Medical Department Personnel

During the past year, doctors, nurses, medical soldiers, litter bearers, civilian personnel, and volunteer aides of the Medical Department cooperated magnificently throughout this global war to provide the armies of the United States with the best in medical care. For your full and unselfish devotion to the care of the sick and wounded, the entire nation is grateful. As Surgeon General of the Army, I greet you with thanks to every one wherever engaged in this unprecedented humanitarian service.

We face now another, possibly more exacting year together, determined to serve each and every patient with all of our strength and all of our skill and to uphold the highest standards of medical service. This is more than arduous work which you have carried on many, many times in the very turmoil of battle. But your record on these distant fields is unsurpassed. Throughout the new year, may still greater achievement, good health, and happiness be with you all.

NORMAN T. KIRK,  
Major General, U. S. Army,  
The Surgeon General.

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## News and Comment

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### THE CONTROL OF DENGUE ON SAIPAN

Shortly following the invasion of Saipan an epidemic of dengue fever occurred among the troops employed in the operation. The rapid increase in the incidence of the disease necessitated prompt control measures. The island commander, on recommendation of the surgeon, designated each unit commander as responsible for the elimination of mosquito breeding within his assigned area and its immediate vicinity. Under the direct supervision of the surgeon, a sanitary company undertook mosquito survey and control work in the more thickly populated areas.

The portions of the island inhabited by our military forces were mapped and segmented as to areas of importance. Tremendous quantities of débris were removed and vast areas were cleared. Water pools were oiled, water containers were emptied or otherwise protected from mosquito breeding, and tree holes were filled with dirt. All measures for mosquito protection were enforced to the utmost. A solution of DDT was used extensively as an insecticidal spray disseminated by mechanical power sprayers and by airplane. All tents, living quarters, and mosquito bars over a wide area were sprayed for a residual effect. Area spraying by aircraft was thoroughly exploited over wide territories.

The effects of these procedures were dramatic. The reduction in the larval and adult mosquito population and in the fly population was outstanding. Within two weeks of the onset of the control program daily admission of new cases of dengue fell more than 80 percent and progressive improvement has occurred since that time.

This experience serves to re-emphasize the effectiveness of command action in disease prevention when promptly utilized and efficiently employed under Medical Department recommendations. It further attests the value of DDT as an adjunct to other sanitary measures in the control of insect-borne diseases.

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From the Tropical Disease Control Division. Preventive Medicine Service,  
Office of The Surgeon General.

### USES AND OPERATION OF A FIELD HOSPITAL

The field hospital has 400 beds when working as one unit and three platoons of 100 beds each when working as individual platoons. It is the most versatile medical unit of the Medical Department and an extremely valuable unit in any theater. A field hospital may be put to any one of the following uses:

- I. When assigned to a base section or theater, a field hospital may be used as:
  - a. A fixed hospital, either as a complete unit or as a platoon on isolated islands or airfields.
  - b. As an air evacuation hospital near an airfield or port.
- II. When assigned to an army:
  - a. An individual platoon can be used as a forward surgical unit reinforced by surgical teams alongside the clearing station of a division for the care of nontransportable, critically wounded patients.
  - b. The individual platoon can be used as an accessory clearing station, either in advanced zones or rear areas.
  - c. The unit can be used for the care of special types of patients (for example, trench foot, malaria, or dysenteries).
  - d. The unit, reinforced by specialized personnel, can be used for care of N-P patients.
  - e. The unit can be used for care of medical patients.
- III. When assigned to an army corps: Same uses as listed under II.
- IV. When used in amphibious operations:
  - a. Individual platoon reinforced by surgical teams assigned to the engineer shore regiment. To set up alongside the beach a clearing station for the surgical care of critical, nontransportable patients who cannot be evacuated from the beach without endangering their lives.
  - b. Individual platoon reinforced by surgical teams assigned to the invading division to set up alongside the division clearing station for the surgical care of the critical nontransportable wounded.
  - c. Individual platoon reinforced by surgical teams assigned to isolated units or special units, as the Rangers, paratroops, special service troops, etc., for the surgical care of the wounded.

### Operation

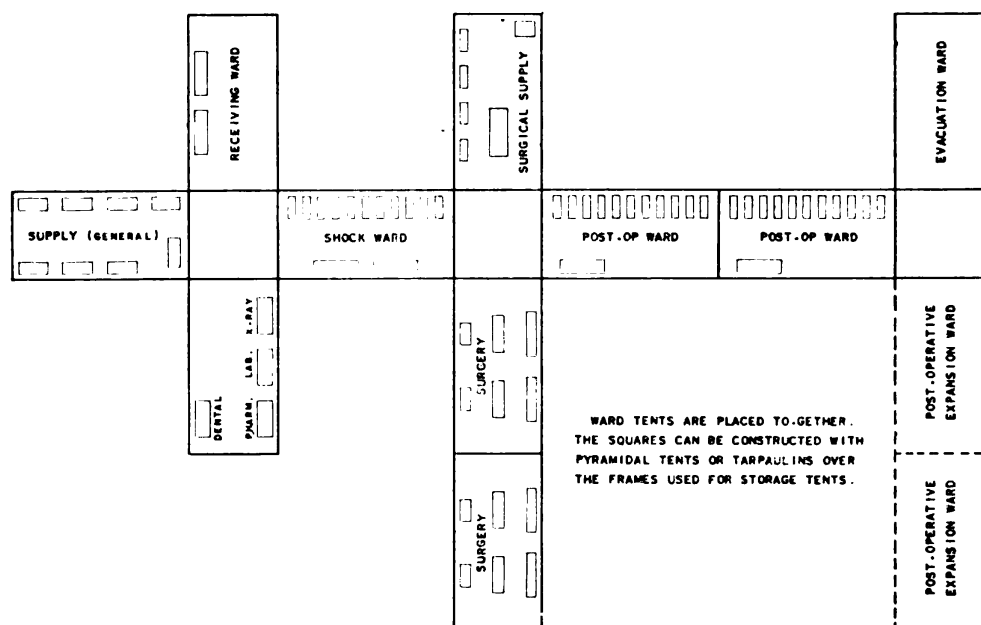
A field hospital has 13 medical officers, 5 medical administrative officers, 3 dental officers, 18 nurses, and 190 enlisted men. It is divided into three identical platoons, each consisting of 4 medical officers, 1 dental officer, 1 medical administrative officer, 6 nurses, and 58 enlisted men. Each platoon is reinforced by four surgical teams and one shock team from the auxiliary surgical group when it is working alongside the division clearing station. Each surgical team consists of 3 medical officers, the surgeon, the assistant surgeon, and the

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Prepared for The Surgeon General by Lieut. Colonel Samuel A. Hanser, M.C., who was in command of the 33d Field Hospital from the time it landed at Oran, Algiers, 2 September 1943, until February 1944, when he was wounded in Italy. At the time of his departure for the homeland, this unit was the most forward installation doing surgery with the Fifth Army.



anesthetist, 1 surgical nurse, and 3 surgical enlisted technicians. The shock team consists of 1 medical officer, 2 shock nurses, and 4 enlisted men trained in shock work. The surgery consists of two connected ward tents (see drawing), containing 4 operating tables and other required items. The individual surgical teams are assigned to each section or operating table. The surgery is placed in charge of one of the platoon medical officers and the platoon surgical nurse, who also has charge of the surgical supply tent which contains autoclaves, sterilizers, sterile supplies and packs, and other necessities, all in chests. The shock tent, or preoperative ward, is equipped with beds, transfusion sets, and other necessary equipment for treatment of patients in shock. The shock tent is in charge of a platoon medical officer and the platoon shock nurse. Two postoperative tents are set up initially, manned by platoon personnel and the remaining 4 platoon nurses and 2 medical officers, working in shifts.



PLATOON PLAN - FIELD HOSPITAL

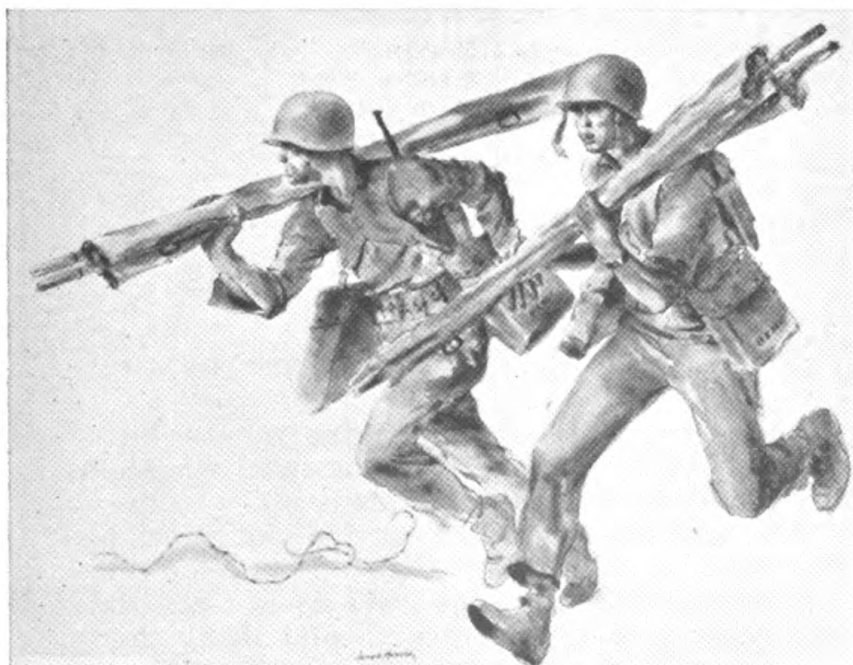
A patient entering the field hospital from the clearing station is brought first into the receiving tent, where the clerk initiates the proper records. Then he is taken to the shock or preoperative tent and assigned to an individual surgical team. He is examined by members of the surgical team and a diagnosis is made with the aid of the available x-ray or laboratory facilities. After a complete work-up and shock therapy, the patient is taken into the surgery, where he is operated on, and is then taken to the postoperative section; hence, he is oper-

ated on as soon as possible after entering the hospital by a qualified surgical team and is followed by the same surgeons until evacuated. Either from the platoon medical officers or from the auxiliary surgical teams the best qualified surgeon is appointed to act as chief of surgery. He is responsible for the surgery performed in the hospital and for making daily records of patients. The receiving tent, mess and supply tents, or sections of the individual platoon are of a routine nature and require no special explanation.

When a field hospital is working as a complete unit, its organization and operation are parallel to either an evacuation hospital or a station hospital, depending on its mission.

#### ON THE DOUBLE

One of many paintings of naval medicine on exhibit in New York, 2-4 November 1944, at the annual meeting of the Association of Military Surgeons of the United States. These paintings were made by several artists who went to the battlefields and lived many weeks with the medical officers and hospital corpsmen in order to carry out their missions. The painting represented here is by Joseph Hirsch. The collection on naval medicine was presented to the U. S. Navy by the Abbott Laboratories, North Chicago, Illinois, which has also sponsored a group of paintings on military medicine for the Army. The Army's paintings will soon be on exhibit for short periods in various parts of the country.





### NUTRITION AND RECOVERY FROM INJURY AND DISEASE

Reports of clinical and laboratory studies continue to emphasize the importance of ensuring adequate nutrition during illness and following wounds, burns, and other injury. Abundant evidence is available to show the deleterious effects of the loss of nutrients following injury and operation and the untoward influence of the negative nitrogen balance and consequent loss of weight, muscular atrophy, and other changes which slow recovery and delay convalescence.

A recent report from NATOUSA on infectious hepatitis describes some results of a study of nutrition in relation to this disease. Analysis of diet records in a general and station hospital revealed average caloric values of the menus of 1,681 and 2,103, respectively, with values as low some days as 1,400 calories. The return of rather large amounts of uneaten food resulted in actual consumption of as low as 800 calories per day in many instances. Similarly, a recent survey of Canadian Army hospitals has shown significant discrepancies between the calculated and the actual consumption, with the result that steps have been taken to correct the situation.

As the NATOUSA report states, one of the disturbing features of acute infectious hepatitis is the rapid loss of weight during the acute phase, and the continuous loss of weight and strength and of tone and quality of the muscle if the disease becomes chronic. There is evidence of other disturbances in nutrition as well. An adequate intake of food, especially protein, has clearly been shown to protect against severe liver damage in this disease and to hasten recovery and shorten the period of convalescence. Although the principal factor in this mechanism appears to be protein (amino acid), the necessity for high caloric intake as a means of sparing protein and providing additional energy to limit weight loss and promote recovery is well recognized.

Such an influence of nutrition is not confined to infectious hepatitis. Other infectious diseases, such as meningitis, may be accompanied by marked alterations in nitrogen balance and other nutritional disturbances. All types of operative procedures, particularly those involving the peritoneum, and various injuries, such as fractures, gunshot wounds, and similar trauma, may be followed by a negative nitrogen balance related to the loss of weight, muscle atrophy, and similar changes which follow. In some instances, alterations in vitamin and mineral nutrition appear to be involved.

The available evidence indicates that more favorable results in such conditions are to be expected when the patients are in proper nutrition at the time of the illness or injury, or are restored to proper nutritional state, and if such a state of good nutrition is actively maintained. For instance, careful studies have shown that proper nutritional preparation on the

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From the Nutrition Division, Preventive Medicine Service, Office of The Surgeon General.

basis of determination of existing nutritional state permits operations which could not otherwise be withstood and, combined with proper postoperative control of nutrition, permits astonishingly early recovery and return to normal activity. The same may be said of recovery from wounds and infectious disease.

Two factors stand out as important in the practical application of this knowledge under conditions as they exist in the Army. One is the maintenance of a proper nutritional state of the troops at all times in order that disease and injury, when they occur, will find optimum conditions of nutrition. The other is the institution of a proper control of the nutrition of the sick and wounded. Together, properly accomplished, they will greatly favor maximum recovery and accelerated convalescence with early return to duty.

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#### PULMONARY DAMAGE CAUSED BY FS SMOKE

FS smoke, which is employed as a screening smoke, can produce severe irritation of the eyes, skin, and respiratory tract when one is exposed to heavy concentrations. Recently, a soldier, after fighting a fire in a building filled with FS smoke, developed symptoms referable to the respiratory tract. He wore a gas mask in the building and experienced no symptoms. On leaving the building, but still exposed to billows of the smoke emerging from the open door, he removed his mask. After a time he had to stop working because of shortness of breath accompanied by cough, choking sensation, and irritation to the eyes, nose, and throat. He was sent to the station hospital, where, after being given oxygen with a B.L.B. mask for 3 or 4 minutes, his cough was markedly relieved.

About twenty minutes after the exposure, the patient was in slight respiratory distress, coughed occasionally, and complained of soreness of the throat and eyes. Examination revealed noisy, asthmatic-type respiration, and numerous medium and coarse bronchial rales throughout the chest, predominantly expiratory and often musical. The patient had no history of allergy or any lung disease. The remainder of the physical examination was normal. On account of the asthmatic character of the symptoms, he was given 0.5 cc. of epinephrine hydrochloride subcutaneously. Ten minutes later the symptoms had decreased but the chest sounds were unchanged. Twenty minutes after the injection, the patient was asymptomatic and his chest had cleared completely except for slight roughness of the breath sounds. He was admitted to the hospital, where he promptly went to sleep and slept well all night. He felt well on the following morning and his chest signs were normal. A roentgenogram of the chest was normal except for pleural adhesions.

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From the Chemical Warfare Branch, Surgical Consultants Division, Surgeon General's Office.

### ARM SPLINT IMPROVISED FROM AMMUNITION CONTAINER

The 105-mm. shell container is well suited for improvising splints for the temporary splinting of fractures of the arm and forearm. The materials are available in any forward area; adaptation of the shell case is simple; the container is rigid enough to protect the injured member during evacuation; the splint is

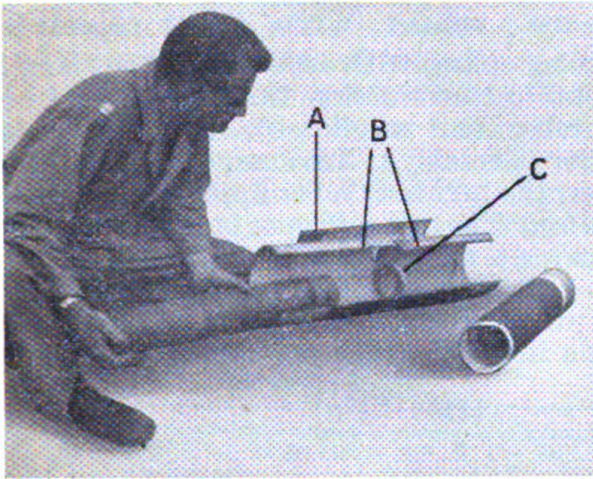


FIGURE 1. Section of shell case; component parts and disassembly: A, outer cylinder; B, inner cylinders (2); C, retaining rings (held by inner cylinders).

light in weight; the arm does not need to be cradled in a muslin bandage as with the ring splint; the length is readily adjustable; and being expendable, it is one less item on property exchange. Captain Herbert A. Iknayan, M.C., with the help of Captain A. H. Hohf, M.C., reports that the metal and plywood retaining rings in the center of the case can be loosened by a sharp blow, freeing either or both lining cylinders from the outer shell of the tube, and the rings can be removed. Either lining cylinder can be fixed at any desired position in the outer cylinder by a single turn of adhesive. Thus, the length can be adjusted. A notch can be cut in the end of the assembly to accommodate the pectoral and subscapularis tendons at the axilla; the extending part of the case thus protects the deltoid and the shoulder joint. Padding of the notch is simple. Windows may be cut as needed.

To apply this splint is no more tedious than to apply the standard arm splint. The adhesive straps for skin traction or the tails from the cestus, or closed fist, type of hand wrappings are led through the tube.

the tube, and the rings can be removed. Either lining cylinder can be fixed at any desired position in the outer cylinder by a single turn of adhesive. Thus, the length can be adjusted. A notch can be cut in the end of the assembly to accommodate the pectoral and subscapularis tendons at the axilla; the extending part of the case thus protects the deltoid and the shoulder joint. Padding of the notch is simple. Windows may be cut as needed.



FIGURE 2. Fixing traction straps on outside.



The traction straps, after splicing the adhesive, sticky side to sticky side, are turned back on the tube and secured by a single turn of tape. This improvised splint offers advantages over the standard full ring arm splint, and its efficacy offsets the disadvantages of tedious application common to all splinting operations.

### TROMBONE TRACTION LEG SPLINT WITH SHOE CLAMP

The trombone traction leg splint, with adjustable shoe clamp, illustrated here, is of metallic construction throughout and so does away with straps, hitches, and windlasses. The apparatus which was devised by Major Clement A. Tavares, M. C., A.U.S., consists of the splint proper, the turnbuckle for applying traction, and the shoe clamp and spring. The splint proper is adjustable for use with any length leg, having a range from 24 to 42 inches. The male element of the splint consists of a modified Army half-ring hinged leg splint with its distal portion sawed off. These rods of  $\frac{3}{8}$ -inch rolled steel slide into the other portion of the splint

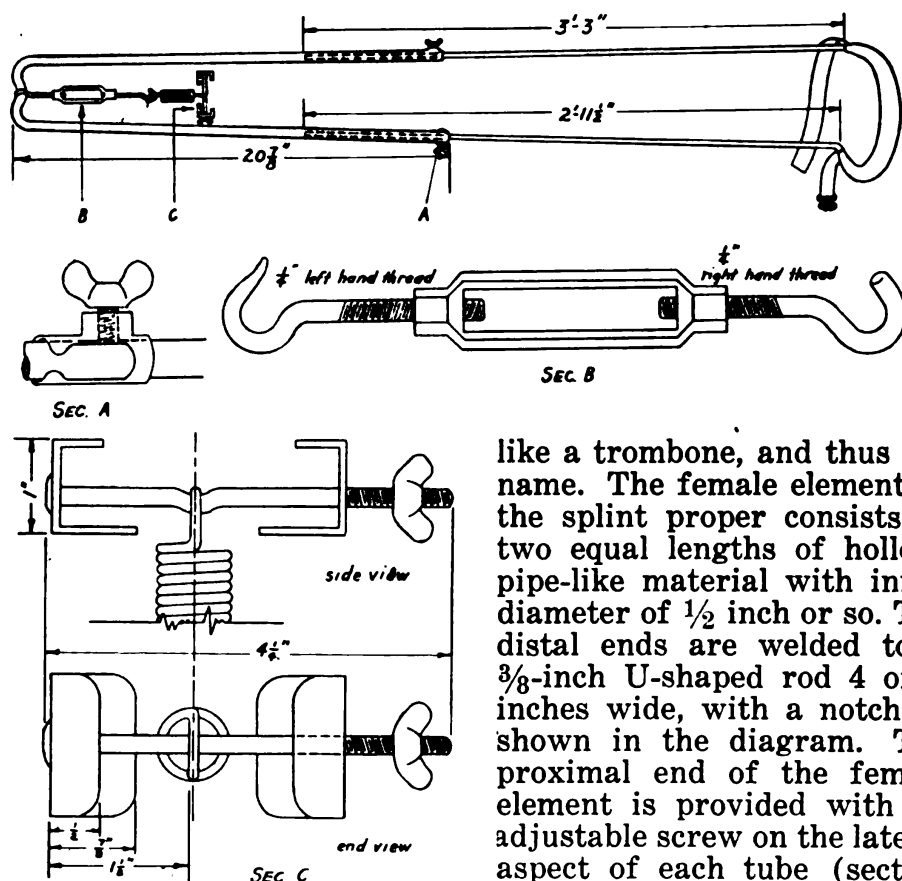


FIGURE 1

commencing traction by means of the turnbuckle. The splint can be used on the right or left leg.

like a trombone, and thus the name. The female element of the splint proper consists of two equal lengths of hollow, pipe-like material with inner diameter of  $\frac{1}{2}$  inch or so. The distal ends are welded to a  $\frac{3}{8}$ -inch U-shaped rod 4 or 5 inches wide, with a notch as shown in the diagram. The proximal end of the female element is provided with an adjustable screw on the lateral aspect of each tube (section A) for adjusting the splint to the length of the leg before



The shoe clamp consists of a  $\frac{1}{4}$ -inch threaded bolt,  $4\frac{1}{4}$  inches long, to one end of which is fixed a U-shaped angular plate made from  $\frac{1}{16}$ -inch bar iron, as shown in section C of the diagram. The other end of the bolt holds a similar plate, which is movable and contains an adjustable winged nut. The center of the bolt is depressed into a notch, which receives one end of a strong 2-inch coil spring (100 lb. capacity). The smaller phalange of each plate is clamped to the outer edge of the shoe and secured by means of the adjustable winged nut for traction. The shoe clamp can be adjusted to fit any size shoe.

The turnbuckle shown in section B of the diagram is an inexpensive commercial turnbuckle with two  $\frac{1}{4}$ -inch bolt hooks, one with a right-handed and the other with a left-handed thread. The central body is  $3\frac{1}{4}$  inches long, and the hooked bolts  $2\frac{1}{2}$  inches long. One bolt hooks on one end of the spring connected to the shoe clamp, while the other hooks over the notched end of the splint. Traction is made by turning the turnbuckle with the fingers.

#### Application

This splint has been used on both tall and short subjects and found highly practical and easy to apply. Furthermore, by virtue of the shoe clamp, it is especially designed for carrying out the principle of rendering emergency treatment to casualties with leg injuries involving fractures, with the shoe on. By means of the shoe clamp, the force of traction is distributed rather evenly over the entire shoe and foot, without any pressure over the dorsum of the foot from straps. By merely turning the turnbuckle, traction may be increased or decreased as desired, with minimum disturbance to the patient.

Figure 2 shows the trombone splint in use, using the regular splint and foot rests (which are spread a bit to accommodate the larger caliber of the splint). Being detachable, the shoe clamp, spring, and

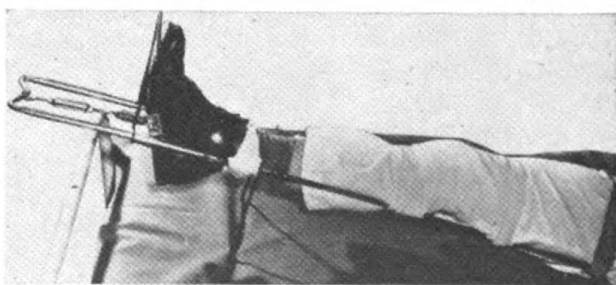


FIGURE 2

turnbuckle can also be used to apply traction to fractures of the lower extremities being transported on Stokes litters. The clamp is fastened to the sole of the shoe at its smallest part as when using the splint, and the distal hook of the turnbuckle attached to the frame of the Stokes litter. Traction is applied by means of the turnbuckle. A pad is placed at the crotch of the patient for comfort, or countertraction may be applied under the armpits. By using two sets of the shoe clamp and turnbuckle arrangement, traction may be applied to fractures of both legs simultaneously.

### REPLACEMENT OF TINCTURE OF GREEN SOAP

The shortage of alcohol makes curtailment of its use desirable when a satisfactory substitute is available. To this end a critical comparison was made of the aqueous solution and the tincture of green soap, and it was concluded that for hospital purposes the solution is, in many respects, superior to the tincture and that its routine substitution involves both a significant conservation of alcohol and a substantial saving of money.

In preparing patients for operation, the aqueous solution of green soap met with unqualified approval when introduced at the Glennan General Hospital. For example, the technique employed by the chief of orthopedic surgery consisted in swabbing the skin with solution of green soap, removal of the soap by swabbing with 50 percent alcohol, and application of a solution of 1 percent iodine and 95 percent alcohol. This procedure was regarded as superior to that which used the tincture of green soap.

On the wards, many gallons of liquid soap are used daily for the cleansing of wounds, and the routine substitution of the aqueous solution for the tincture of green soap has met with complete satisfaction. For the washing of instruments especially, the solution is preferred because of its superior detergent qualities.



Officers in the field in Australia prepare for a surgical operation. Signal Corps photograph.

Soap in alcohol is a true solution and therefore devoid of detergent qualities. In aqueous solution, however, soap is in colloidal suspension, in which form its detergent action is manifested. Furthermore, the solution of soap is more alkaline than

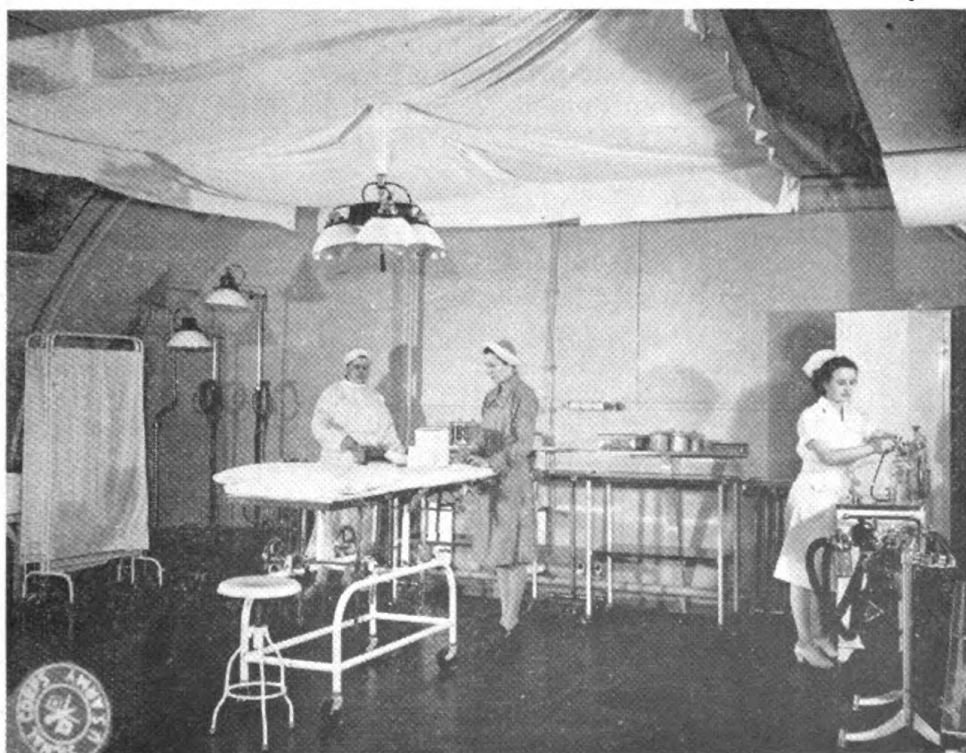
Prepared by Tech. Sgt. Alfred E. Berkowitz, chief pharmacist, Glennan General Hospital, Okmulgee, Oklahoma (see the October 1944 Bulletin, page 27).

the tincture. Advantages of its relative alkalinity are (1) that almost all bacteria which infect the skin, with the exception of pyocyaneus, grow best on the acid side, and (2) that the local action of sulfonamides is enhanced by increasing the pH. Another advantage of the solution is that it eliminates the danger of reaction in patients who are sensitive to the tincture.

The conservation of alcohol by the use of solution of green soap was demonstrated by analysis of the pharmacy records at the Glennan General Hospital for the period from 1 October to 14 October 1944. In this two-week interval, 168,770 cc. of the solution of green soap were dispensed. Since the alcoholic content of the tincture is 30 percent, this effected a saving of alcohol of 50,661 cc., or 53.55 quarts. On this basis the calculated saving of alcohol for a year is 348.1 gallons.

The financial saving involved was demonstrated in the same manner. The alcohol used in the above two-week period, at the current Medical Supply Catalog price of 33 cents a quart, would have cost \$17.67. The calculated saving to Glennan General Hospital for a year is \$459.46.

It is suggested, on the basis of facts, that hospitals restrict the manufacture of tincture of green soap and substitute for it the solution of green soap because of the lower cost, the saving of alcohol, and the clinical advantages involved.



Operating room in a U. S. Army hospital in Iceland.

## STUDY OF PARADICHLOROBENZENE IN FLY CONTROL

A preliminary report on the use of paradichlorobenzene in the control of flies in pit latrines in the Central Pacific Area has been received from Captain Franklin Sherman, III, Sn.C. The varieties of flies which infest latrines in this area are: houseflies, flesh flies, green-bottle flies, and bluebottle flies. The bluebottle fly (*Chrysomya megacephala*), which has been the most persistent offender, has proved highly resistant and troublesome in latrines receiving treatments that destroyed the other species.

To find a more effective control for flies in pit latrines, extensive tests were made over a period of five months in a large number of heavily infested latrines. The materials tested were:

1. Quartermaster latrine oil (crankcase drainings 75 percent, kerosene 25 percent, or Diesel oil 90 percent with cresol 10 percent). Daily application, 3 gallons per latrine.

2. Quartermaster latrine oil, with addition of both 10 and 20 percent of crude creosote oil, applied daily, 3 gallons per latrine.

3. Paris green solution,  $1\frac{1}{2}$  pounds Paris green, 50 gallons water. Biweekly application, 10 gallons per latrine.

4. Borax in solution, 1 pound in 4 gallons of water. Biweekly application, 10 gallons per latrine.

5. Paris green and hydrated lime dust (one part Paris green to four parts hydrated lime), applied daily, 5 to 6 pounds per latrine.

6. Borax, powdered, 5 to 8 pounds scattered over surface of latrine. Biweekly application by hand.

7. Salt (sodium chloride), 5 pounds per latrine hole, scattered daily over surface of pit by hand.

8. Paradichlorobenzene, 5 to 8 pounds initial application, scattered by hand over pit surface, followed by 2 to 3 pounds at biweekly intervals.

Each material tested, with the exception of salt, showed partial effectiveness against maggots, especially those of the housefly; however, maggots of the bluebottle fly (*Chrysomya megacephala*) persisted in all latrines throughout the tests, excepting those receiving paradichlorobenzene, which was outstanding in its destruction of all maggots within twenty-four hours in each latrine in which it was tested. After the initial treatment with 5 to 8 pounds of paradichlorobenzene, from 2 to 3 pounds of this material applied biweekly not only kept the pits completely maggot free but excluded all adult flies.

Additional field and laboratory tests were made with paradichlorobenzene which, without exception, proved equally effective for maggot and fly control. Paradichlorobenzene was tested also under combat conditions where there were swarms of flies in unscreened latrines made from knockdown quartermaster boxes. Biweekly applications of paradichlorobenzene kept these latrines free from both maggots and flies. Two men were able to treat the eighty-five latrines used in this operation.

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An abstract.



The toxic effects of paradichlorobenzene are due largely to its gaseous fumes, which are 5.1 times heavier than air, thus tending to settle downward and attaining its greatest concentration at the bottom of any container. When crystals of paradichlorobenzene are covered with earth, the evolving gas penetrates several inches in all directions throughout the soil. This material is generally available in crystals of about  $\frac{1}{4}$  inch in size, from which the gas is given off continuously until the crystals have been completely used up. This is important when the insect requires a long exposure to produce toxicity. Dispersal of the crystals over the entire pit latrine surface gave a quicker and more even distribution of the gas than by suspending the crystals in any manner within the pit.

The comparative larvicidal tests which the author made indicate, he says, that the paradichlorobenzene treatment of pit latrines is highly effective in this area. This application requires no apparatus. The crystals are simply scattered on the surface of the pit by hand. Logistically, 1,000 pounds of paradichlorobenzene will completely control fly breeding in latrines that would require at least 18 tons of oil, and the application requires one-twelfth the time that oil would require.

*Editorial note:* Paradichlorobenzene is a nonstandard item in very limited production. No requisitions for this chemical can be honored. In addition, a determination of its toxicity and safety for wide-scale employment would have to be made before its use could be given official sanction.

The DDT insecticides are now available and are highly effective in fly control.



A British and an American soldier check ambulances stored in supply depot in Britain for the invasion of Europe. 17 March 1944. Signal Corps photograph.

**GRADUATE EDUCATION FOR PHYSICIAN VETERANS**

The Retraining and Re-employment Administration, Office of War Mobilization, Washington, D. C., has published a booklet entitled, "Your Rights and Benefits; a Handy Guide for Veterans of the Armed Forces and Their Dependents." This booklet is divided into three parts: (1) things to do immediately after discharge, (2) benefits for veterans, (3) benefits for dependents. Of special interest to physician veterans is the section on education in which it is said that educational aid for veterans is available from the Veterans' Administration, provided: (1) you were discharged under conditions other than dishonorable; (2) you were not over 25 at the time you entered the service, or can demonstrate that your education or training was interrupted or interfered with by your service, or if you desire a refresher or retraining course; (3) you served ninety days or more (not counting the time in Army Specialized Training Program or Naval College Training Program, which course was a continuation of a civilian course and which was pursued to completion, or as a cadet or midshipman in a service academy) or were discharged or released from service because of an actual service-incurred injury or disability; and (4) you start such education not later than two years after discharge or end of war (whichever date is later).

*Length of training.* One year (or its equivalent in part-time study). If you complete these courses (except refresher or retraining courses) satisfactorily, you will be entitled to additional education or training not to exceed the length of time you spent in active service after 16 September 1940 and before the end of the present war (not including A. S. T. P. or Naval College program). No course of education or training shall exceed four years. You may select your own course at any educational or training institution which accepts you as qualified to undertake them, provided the institution is on the list approved by the Veterans' Administration.

*Expenses paid.* The Veterans' Administration will pay to the educational institution the customary cost of tuition, and such laboratory, library, infirmary, and similar payments as are customarily charged, and may pay for books, supplies, equipment, and such other necessary expenses (exclusive of board, lodging, other living expenses, and travel) as are required. Such payment shall not exceed \$500 for an ordinary school year. The Veterans' Administration will also provide a subsistence allowance of \$50 a month if you have no dependents, \$75 if you have (this may be reduced, however, if you attend on a part-time basis or receive compensation for work done as part of your training). You may also want to apply for school or college credit for what you learned in the service, or a record of it to show your prospective employer. For information on this subject, Army personnel may write to U. S. Armed Forces Institute, Madison 3, Wisconsin.

For a further interpretation of the law on this subject, members of the Subcommittee on Postwar Education of Physician Veterans, of the American Medical Association, held a conference<sup>1</sup> with officials of the Veterans' Administration on 16 October 1944. With reference to Section 400, Part VIII, paragraph 1 ("Any person who served in the active military or naval service on or after 16 September 1940 and prior to termination of the present war and who shall have been discharged . . . and whose education or training was impeded, delayed, interrupted, or interfered with by reason of his entrance into the service . . . and who shall have served ninety days or more . . . shall be eligible for and entitled to receive education or training under this part"), the official (Mr. Harold V. Stirling, director of Vocational Rehabilitation and Education Service of the Veterans' Administration) was of the opinion that any physician who is now in any of the branches of the service and has been on active duty for more than ninety days will be eligible for any of the benefits provided by the law. Even those who are more than 25 years old and desire refresher or other courses, it is said, will no doubt be considered eligible, even though they may have entered the Army at a time when their education might have been assumed as completed, since the law in providing refresher and retraining courses is naturally to be interpreted in a liberal spirit. Any person who has been in active service for three months will be entitled to a period of one year of education or for such lesser time "as may be required for the course of instruction chosen by him." Thus, servicemen who have been in the service for more than three months may receive additional periods of education or training, the period "not to exceed the time such person was in active service on or after 16 September 1940 and before termination of the war." Periods during which a serviceman was receiving his education under the auspices of the Army or Navy while on active duty cannot be counted toward time credit for a prolongation of the educational period. The committee asked Mr. Stirling to apply this to the ordinary clinical residency. It was explained that the residencies in our hospitals, for example, were one, two, or three years or more in length. He replied: Those in service three months are entitled to one year's further education; those in service twelve months are entitled to two years' further education; those in service twenty-four months are entitled to three years' further education. Intermediate periods of service entitle the serviceman to intermediately long periods of education; thus, if a serviceman has served six months, he is entitled to eighteen months of further education.

*However, the law specifically states that any physician who entered the service when more than twenty-five years of age will be entitled to not more than one year of postgraduate education unless he can show that his education was impeded, delayed, interrupted, or interfered with by entering the service.*

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1. J. A. M. A., 11 November, page 709.

Among other benefits provided for veterans who served on or after 16 September 1940 and before the end of the present war, and who are discharged or released under condition other than dishonorable after active service of ninety days or more, or because of service-incurred injuries or disability, are three types of loans for homes, farms, and business. The Administrator of Veterans' Affairs will guarantee up to 50 percent of any such loan or loans, provided the amount guaranteed does not exceed \$2,000. Loans guaranteed by the administrator bear interest of not more than 4 percent per year and must be paid up within twenty years. The Administrator will pay the interest on the guaranteed amount for the first year. Applications must be made within two years after discharge or separation, or two years after the end of the war (whichever is later), but in no event more than five years after the end of the war. Information is available at any facility of the Veterans' Administration.

#### ANNUAL MEETING OF MILITARY SURGEONS

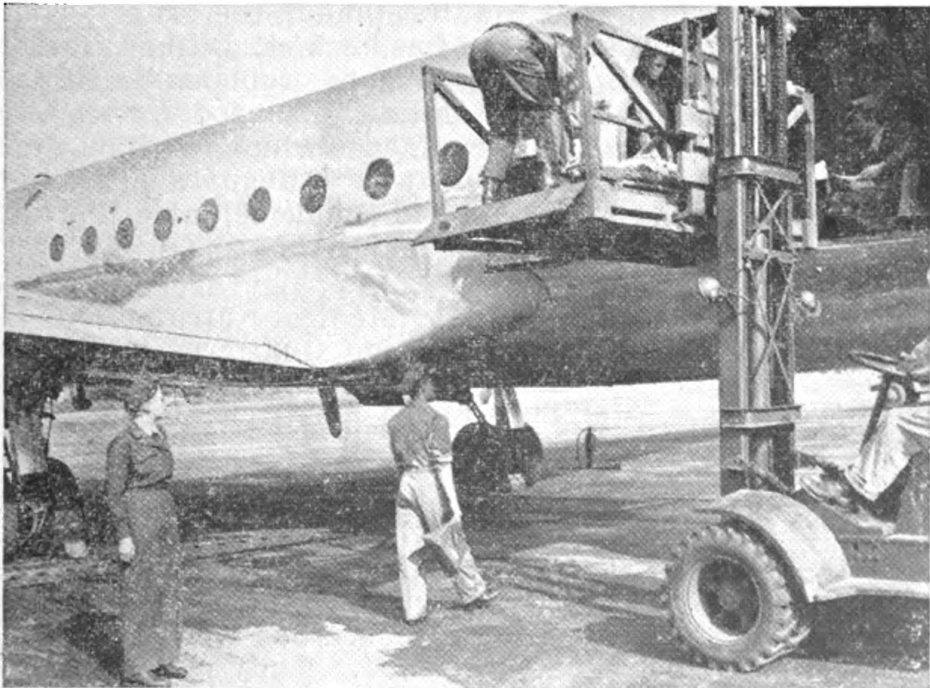
The successful and well attended 52d annual meeting of the Association of Military Surgeons of the United States was held in New York, 2-4 November 1944, under the presidency of Colonel Lucius A. Salisbury, M.C., A. U. S. The program comprised forum lectures on war surgery, war medicine, chemotherapy, medical combat problems, and panel discussions on tropical diseases, wounds, fractures and amputations, penicillin and sulfonamide therapy, neuropsychiatric problems, neurosurgical problems, reconditioning, shock, blood substitutes and blood derivatives, aviation medicine, war dentistry, veterinary medicine, sanitary engineering, and Medical Administrative Corps functions; also motion pictures on war medicine, extensive exhibits by the services, commercial exhibits, and luncheon meetings.

At the annual dinner on Army night, the address of the evening was presented by Major General Norman T. Kirk, The Surgeon General, U. S. Army. The Honorable Fiorello H. LaGuardia, mayor of New York City, spoke, and the foreign guests were presented with life memberships and the medal of the association. The Gorgas Medal was presented to Commander James J. Saper, M.C., U. S. N.; the Wellcome Medal to Commander Alvin F. Coburn, M.C., U. S. N. R.; and the Founders Medal to Colonel Charles M. Walson, M.C., chairman of the Executive Committee, and to Colonel F. H. Foucar, M.C., chairman of the Scientific Exhibits Committee. On Navy night, the address of the evening was presented by Vice Admiral Ross T. McIntire, Surgeon General, U. S. Navy. Colonel Irvin Abell, M.C., U. S. A., was elected president and Colonel William H. Triplett, M.C., A. U. S., vice-president. The first and second vice-presidents, Deputy Surgeon General Warren F. Draper, U.S.P.H.S., and Brigadier General Edgar Erskine Hume, U. S. A., are out of the country.



### PNEUMATIC PANTS FOR FIGHTER PILOTS.

The War Department has announced that fighter pilots of the Eighth and Ninth Air Forces now are equipped with pneumatic pants which prevent them from "blacking out" in maneuvers against the enemy. This equipment, known as the G-suit, applies pressure to the pilot's legs and abdomen during a pull-out or turn, thus preventing the blood from pooling in the lower extremities and enabling the pilot to make tighter turns in level flight and sharper pull-outs from power dives. The G-suit combats the effects of forces many times the gravity on the body, against which the heart is unable to pump sufficient blood to the brain. Airmen had learned by experience that shouting and crouching tensed their muscles and helped to raise their gravity tolerance by restricting the downward flow of blood, but these methods also prevented the pilot from seeing through his windshield, from watching from behind and above for the enemy, and from sighting his guns during the turn or pull-out. With the G-suit, fighter pilots are unable to black out and suffer much less fatigue following combat maneuvers. This equipment, which resembles tight, high-waisted pants, supplies pressure over the abdomen and legs by means of bladders inflated by compressed air. Only two seconds are required to inflate or deflate the bladders by means of an automatic valve when the force of gravity rises above or falls below 2-G. All the pilot has to do is zip on the suit and plug it into the air line before taking off.



A special "lift" for loading patients on aircraft. The nurse will accompany these patients back to the United States. Signal Corps photograph.

### PROCEDURE FOR SHOE FITTING

Medical officers were advised in *The Bulletin* of November 1943 not to prescribe a definite size of shoe to be issued in exchange for one found by them to be the improper size for an enlisted person, but to state only that the size of the shoe worn does not fit properly and to request the quartermaster to determine the proper size in accordance with AR 850-125.

The Office of The Quartermaster General has called to the attention of The Surgeon General's Office the fact that while medical officers of most installations have observed the practice referred to above, medical officers of some installations appear as yet to be unfamiliar with this practice. A representative of The Quartermaster General's Office has reported that medical officers in a number of installations still prescribe a definite size of shoe to be issued in exchange for one found by them to be the improper size. Attention is again called to the item in *The Bulletin* for November 1943, page 68, entitled "Procedure for Shoe Fitting," and to AR 850-125.

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### THE MEDICAL NUTRITION LABORATORY

The transfer of the nutrition laboratory located at the Army Medical Center, Washington, D. C., to the Chicago Quartermaster Depot, and the new name, the Medical Nutrition Laboratory, for this agency, have been authorized by A.S.F. Circular No. 305, 14 September 1944. This laboratory will operate as a Class IV installation under the jurisdiction of The Surgeon General. For the first time in the history of the Medical Department, an agency has been established the sole function of which will be to investigate problems bearing on the nutritional health of the soldier. The need for such an activity arose because of the prominence which nutrition problems have attained in the present war. Adequate nutrition is an important phase of preventive medicine, affecting the soldier's morale, physical fitness, and general health.

Facilities for investigating the physiologic aspects of food and feeding will be available in the Medical Nutrition Laboratory, and the location at the Chicago Quartermaster Depot will permit this medical agency to work in close cooperation with the Quartermaster Subsistence Research and Development Laboratory, to which it will be adjacent. The Army has thus centralized for investigative work two agencies interested in different aspects of problems related to food. Technical experts in the development and packaging of rations, the determination of nutritive content of the component food items, the effects of storage on nutritive content, and similar matters will join forces with those concerned with the physiologic aspects to assure a comprehensive study of all types of such problems encountered by troops in the field and in combat. Colonel John B. Youmans, M.C., chief of Nutrition

Division, Surgeon General's Office, and Colonel George F. Doriot, Q.M.C., chief of Research and Development, Quartermaster General's Office, were in a large part responsible, under The Surgeon General's supervision, for making possible the realization of such close and necessary liaison.

While the research program of the Medical Nutrition Laboratory is not yet established in detail, the following principles will govern the choice of problems: (1) Does it have medical significance? (2) Does it have practical importance in actual field and combat conditions? (3) Is it likely to result in a practical and applicable solution of the problem at hand? Types of problems answering these requirements are as follows: the development of rapid physical, clinical, and biochemical methods of appraisal of nutritional status; determination of the reliability and significance of physical signs thought to be indicative of nutritional deficiency; determination of the interrelationship of physical, clinical, and biochemical signs of nutritional deficiency; determination of the earliest important signs of nutritional failure; and the relation of nutritional state to disease and the recovery and convalescence from wounds and illness. Such investigations will receive early attention; however, it is hoped that medical officers everywhere will take an active interest in the work of the laboratory and will suggest problems which they believe important in the field of medical nutrition as they have encountered them in the widely different environments of the various theaters of operation.

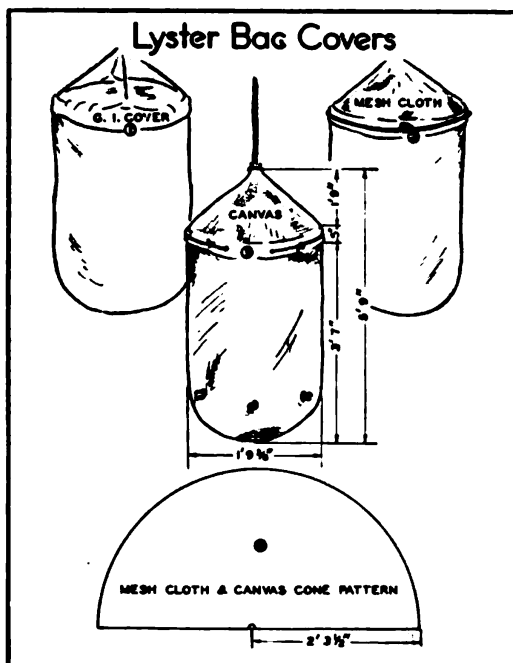
The Division of Nutrition, Army Medical School, early in 1942, proposed and obtained approval for a small laboratory; while until that time the activities of the Division had been largely educational, the increasing number of nutritional problems warranted establishing an investigative agency. Adequate personnel, however, were not always available for the investigation of problems requiring large numbers of troops; nevertheless, the support of the director of the Army Medical School, Colonel George R. Callender, M.C., resulted in the study of many problems which contributed to the unexcelled record attained by preventive medicine during this war. Examples of problems investigated are: the 100-day field test of the B ration carried out at Camp Lee; the determination of the nutritive content of the B ration and the effects of its prolonged storage and preparation; the improvement and testing of the hospital ration which had been developed earlier; the feasibility of sprouting legumes for an accessory source of vitamins for use in the field; the effect of vitamin supplementation of the growth media on the production of the Army's triple typhoid vaccine; the participation of the Division in the recent tests of ration C, K, and 10 in 1 recently carried out in Colorado.

The personnel of the nutrition laboratory at the Army Medical School will form the nucleus of the staff of the Medi-

cal Nutrition Laboratory. Captain George H. Berryman, Sn.C., and First Lieut. Cyrus E. French, Sn.C., have been designated acting commanding officer and acting executive officer, respectively. Miss Jane Spinella, a food specialist, has many years of experience in hospital dietetics. Others will be added to make a complement of twenty-two, of which eight will be officer personnel. The laboratory will be under the supervision of Major William F. Ashe, Jr., assistant director of the Nutrition Division, Surgeon General's Office. It is expected that the work of the Medical Nutrition Laboratory will result in further improvement of the soldier's health and will add contributions of scientific importance to the long list now credited to military medicine.

#### LYSTER BAG COVERINGS

A general hospital in the Burma-India Theater has devised protective coverings for their Lyster bags in order to minimize contamination of water by insects and to prevent particles of twigs and leaves which fall on the Lyster bag cover (figure 1) from being washed into the bag by rain water. The Lyster bags are equipped with a cone-shaped mesh cloth (figure 2) cut out in a semicircular pattern with a  $27\frac{1}{2}$ -in. radius (figure 4). The mesh cloth is sewed together near the top of the supporting ropes of the Lyster bag and also along the sides of the cloth where the edges of the fabric overlap. The bottom part of this mesh cloth extends at least five inches below the top cover of the bag and is held to the sides of the Lyster bag by means of an elastic belt made from salvaged rubber tubing. Protecting the mesh cloth from the elements is a cone-shaped, canvas cover made from salvaged canvas (figure 3), securely fastened at its apex about the upper part of the Lyster bag, supported and held together at its overlapping sides by means of three sets of drawstrings that are about five inches from each other.



Prepared from the sanitary report for September 1944 by the Sanitation and Hygiene Division, Preventive Medicine Service, The Surgeon General's Office.

### SCRUB TYPHUS NOT A CAUSE OF CHRONIC HEART DISEASE

The occurrence of cases of scrub typhus (tsutsugamushi disease) in soldiers in certain oversea areas has given rise to widespread interest in possible persistent damage to the body, especially the heart. A large number of cases have received thorough study by several independent groups of observers. It is apparent that certain clinical and postmortem findings have been misinterpreted.

Postmortem examinations following scrub typhus often show very widespread lesions, consisting of small perivascular cellular accumulations, occasionally associated with slight hemorrhage. In severe cases, there may be cellular infiltration and edema of the interstitial tissue and even small areas of necrosis in tissue cells. Such lesions are not uncommon in the myocardium. However, the nature and size of these lesions are not such as to suggest any difficulty in their satisfactory healing. One autopsy recently studied is of special interest. This soldier died on the thirty-fifth day of scrub typhus of a complication not directly connected with the disease. The lesions of scrub typhus, including those in the myocardium, were identifiable but were practically completely healed. The resulting scar tissue would be so slight as to be unlikely to interfere with normal function.

Scrub typhus is a general infection which affects the body as a whole. During the height of the disease many symptoms and signs may occur which might seem to have a myocardial origin. Clinical study, however, shows that many of these signs are generally attributable to involvement of the lungs, the peripheral vascular system, or the central nervous system. True congestive heart failure and cardiac enlargement are rarely seen. Teleoroentgenograms and electrocardiograms are normal in the overwhelming majority of cases. In a few instances, serial electrocardiograms show transient abnormalities of the sort encountered in many severe infections.

Convalescence from scrub typhus is often prolonged. Careful follow-up of patients, however, has not brought to light any instance of chronic heart disease. In early convalescence, many patients, especially when inadequately supervised, show sleeplessness, tremulousness, lack of ability to concentrate, easy fatigue, excessive sweating, palpitation, labile pulse with ready tachycardia, and low blood pressure. Occasionally, shortness of breath and intrathoracic discomfort are said to be present. In fact, many convalescent patients for a time present the picture of neurocirculatory asthenia. These symptoms and signs are not to be attributed to cardiovascular disease in itself, but rather to the general effects of the infection. They clear up in time, depending on the sever-

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From the Tropical Disease Treatment Branch, Medical Consultants Division, Surgeon General's Office.



ity of the disease, the constitution of the individual, and the skill with which convalescence is managed.

Louse-borne typhus produces a similar picture. In this disease, myocardial lesions are at least as prominent as they are in scrub typhus. In spite of careful study and follow-up for years of large numbers of patients with louse-borne typhus, no evidence has been found that chronic heart disease results from the infection.

It may be concluded that, even though convalescence is prolonged, recovery from scrub typhus is ultimately complete. In particular, there is no evidence of the occurrence of chronic heart disease. Patients who may have been disturbed by rumors to the contrary should be assured that they need not fear the development of permanent damage to the heart or other organs.

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#### PLANS OF THE COUNCIL ON DENTAL HEALTH

Dentists in military service have had the rare opportunity of obtaining a comprehensive view of the dental needs of our country. Dentists in service are preoccupied with the pressing problem of dentally rehabilitating men for the fighting front. Dentists on the home front are making an all-out effort to care for the dental needs of war workers. Despite long hours and overwork, the dental profession has not lost sight of the overall problem of developing a more adequate dental health program for the American people. Through the dental organizations, national, state, and local, dentistry is attacking this problem in an effort to arrive at a solution that will be satisfactory to both the public and the profession.

The Council on Dental Health of the American Dental Association is charged by the dental profession with the responsibility of developing a satisfactory dental health program for all of the American people. The Council on Dental Health, which was established by the House of Delegates, was formed by merging two former standing committees: the Committee on Public Health and Education and the National Health Program Committee. Forty state dental societies have councils on dental health, seven have standing committees of a similar nature, and local societies are establishing similar councils. Thus, dentistry is studying dental needs and methods by which those needs can be met.

The Council on Dental Health has undertaken an exhaustive study of all phases of the dental-social problem. It has enlisted men of outstanding ability in allied social and economic fields to serve on its subcommittees. Thus, it hopes to take advantage of the advice of men both within and without the profession.

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Prepared by Walter A. Wilson, D.D.S., chairman, Professional Relations Committee, Council on Dental Health of the American Dental Association.



**MEDICAL DEPARTMENT TRAINING FILMS**

The following films are available to military personnel by requisition on Signal Corps film libraries and sublibraries in posts, camps, and stations, overseas and in the zone of the interior.

**TRAINING FILMS**

- TF 8-155 Personal Hygiene  
8-953 Malaria: Cause and Control  
8-999 The Fly  
8-1000 The Louse  
8-1174 Purification of Water  
8-1179 Disposal of Human Waste  
8-1180 First Aid for Chemical Casualties  
8-1238 Sex Hygiene  
8-1288 Louse-Borne Diseases  
8-1297 Personal Health in Snow and Extreme Cold  
8-1343 Care of the Sick and Injured. Part I,  
Morning Care  
8-1344 Care of the Sick and Injured. Part II.  
Evening Care  
8-1345 Care of the Sick and Injured. Part III.  
Postoperative Care  
8-1346 Care of the Sick and Injured. Part IV,  
Temperature, Pulse, and Respiration  
8-1366 Hypodermic Syringes and Needles—  
Their Care and Function  
8-1378 Clinical Malaria  
8-1382 Care of the Sick and Injured—Surgical Dressing  
8-1383 Care of the Sick and Injured—Enemas  
8-1388 The Heart and Circulation  
8-1389 Mechanism of Breathing  
8-1390 Digestion of Foods  
8-1391 Control of Body Temperature  
8-1392 The Work of the Kidneys  
8-1393 The Nervous System  
8-1394 The Eyes and Their Care  
8-1395 Endocrine Glands  
8-1396 Body Defenses Against Diseases  
8-1402 Introduction to Combat Fatigue  
8-2047 First Aid for Battle Injuries  
8-2049 First Aid for Nonbattle Injuries  
8-2057 Personal Health in the Jungle  
8-2060 Pick-Up  
8-2070 Reconditioning Convalescents for Return to Duty  
8-2080 Plaster Casts  
8-2083 Swinging Into Step

**FILM BULLETINS**

- FB 132 Evacuation of the Wounded  
146 Medical Service in the Invasion of Normandy  
147 Medical Service in the Jungle

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From the Training Division of The Surgeon General's Office.

## MISCELLANEOUS FILMS

- Misc. 157 The Mosquito  
942 Fight Syphilis  
943 For Your Information  
944 The Magic Bullet  
947 Amputation of the Lower Extremity  
956 Meet McGonegal  
1003 Know For Sure  
1046 Silent Battle (Malaria—Australian)  
1035 Private Snafu in Malaria  
1081 Reconditioning in E.T.O.

## OTHERS

USPHS Film, Syphilis (of primary interest to Medical Corps officers)

T.C. 87 (physical training)

TF 1-3343 Malaria Discipline, Army Air Corps

Further information on the most recently available films:

TF 8-2070, Reconditioning Convalescents for Return to Duty, presents a comprehensive picture of the reconditioning program including occupational therapy, educational, and physical reconditioning. It covers the reconditioning of patients in each of the four classes. Prints of this film are now being distributed to the Signal Corps libraries.

TF 8-2080, Plaster Casts. The preparation and application of plaster has assumed great importance in the treatment of military casualties. This new film will facilitate the training of Medical Department enlisted technicians. It shows the technique from simple preparation of bandage to application of difficult casts. All of the duties of the plaster room technician are portrayed, with special emphasis on the correct procedures and the practices to be observed in the application and removal of casts. Medical students and officers will find this film interesting and instructive.

TF 8-208, Swinging Into Step, a recent film for amputees, has been produced for the training and morale of a specific war casualty in order to portray details in the treatment and rehabilitation of such cases. The opening scene shows patients returning on a hospital ship, including a group of amputees, who have many questions pertaining to their hospital treatment and convalescence. All aspects of the amputation program are brought out, including surgical care, limb fitting, physical therapy, occupational therapy, reconditioning, and various forms of recreation. Both lower and upper extremity amputations participate in the picture, showing the progressive training at amputation centers until the patient is discharged. Finally a group of civilian and war casualties illustrate the ability of various types of amputees who have returned to their homes and to jobs in all walks of life. This film is being

distributed to overseas theaters and to amputation centers and film libraries in the zone of the interior.

Film Bulletin 132, *Evacuation of the Wounded*, shows the echelons of medical service from the time the man is wounded until returned to the zone of the interior.

Film Bulletin 146, *Medical Service in the Invasion of Normandy*, shows the detailed Medical Department planning peculiar to the particular operation. The medical service rendered in the initial stages of the invasion of Normandy and that rendered after echelonment could be established on the Normandy peninsula are depicted graphically and in combat photography. It shows the manner in which the wounded were evacuated and professionally cared for in the initial stages of the invasion of Normandy.

Film Bulletin 147, *Medical Service in the Jungle*, is an effective film designed to orient Medical Department personnel in units destined to operate in the jungle. It presents problems arising as a result of climate and terrain and the way in which they were solved by troops actually employed in combat.

The following film projects on designated subjects are in various stages of development. As they are completed their availability will be announced in FM 21-7, *List of Training Film Strips and Film Bulletins*.

- TF Project, Ward Care of Psychotic Patients
- TF Project, VD Control for Colored Troops
- TF Project, Getting Personal (Personal Hygiene for Women)
- TF Project, Dental Health
- TF Project, Figures Don't Lie (Physical Fitness for Women)
- FB Project, Field Hospital
- FB Project, Evacuation Hospital
- FB Project, Blood Bank in NATOUSA
- FB Project, Insect Repellents and Insecticides

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#### GAS MASKS FOR PATIENTS WITH HEAD WOUNDS

A gas mask has been developed to protect patients with head wounds against gas attacks. The mask, known as M-7-11-9, the first such device which protects patients with bandaged heads, faces, or jaws, was designed, at the request of the Medical Department, at the Chemical Warfare Service Development Laboratories, Massachusetts Institute of Technology. It is pulled over the head like a sack and the skirt of the hood fastens tightly around the neck, or the hem can be taped to the chest to obtain a gastight seal. It is for use in hospitals or other installations vulnerable to gas attacks from the air. A flexible window across the eyes provides clear vision, and an air-purifying canister is attached to the silklike plastic hood. The new mask has been tested at the Medical Research Laboratories at Edgewood Arsenal and is now in production by the Firestone Rubber and Latex Company and the National Carbon Company.

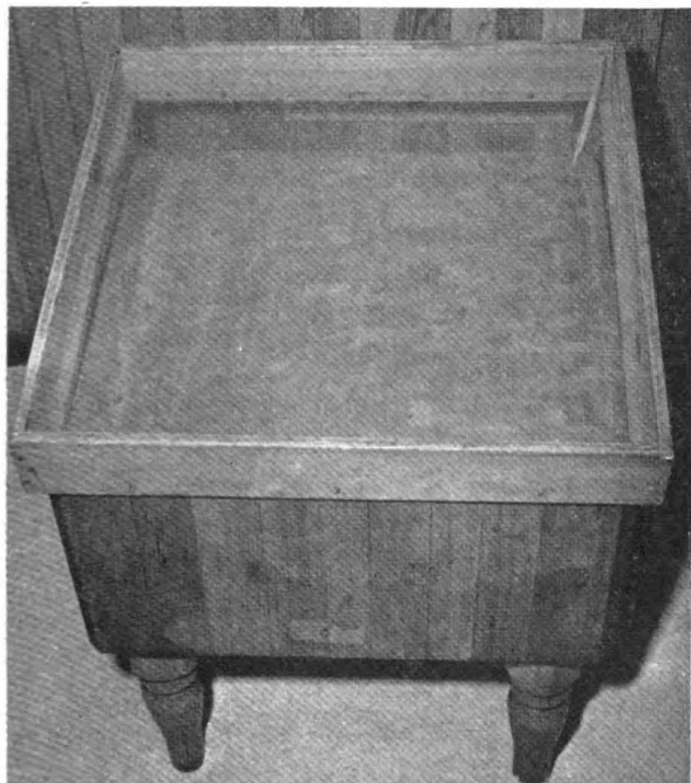


### SANITARY COVER FOR MEAT BLOCKS

The usual procedure of covering a meat block with salt does not keep insects off the block nor does it permit inspection of the block for cleanliness. Furthermore, its use precludes complete aeration. For these and other reasons, a wooden cover for

meat blocks was devised\* and is now in use at all messhalls in Camp Ross, Wilmington, California.

The cover consists of a wooden frame that fits snugly around the top of the meat block, overlapping at the sides. A wooden ledge is nailed on the inside, about three inches from the bottom of the cover. This ledge rests on the top of the meat block. The top of the frame is then covered by wire screening, which is nailed in place and then secured by half-round



Meat block cover in place with one end propped up. Signal Corps photograph.

molding. Wooden corner braces may be used, if desired, to strengthen the frame. The top of the cover should be at least six inches from the top of the meat block. Specific dimensions for the cover are not given because the size of meat blocks varies.

### MONTHLY MEDICAL MEETING

The regular monthly medical meeting at the Army Medical Center, Washington, D. C., 16 November 1944, was addressed by Lieut. Colonel Theodore C. Thompson on "Amputations of the Upper Extremity," Lieut. Colonel Lloyd G. Lewis on "War Wounds of the Urinary Tract," Colonel Rettig A. Griswold on "Transthoracic Gastrectomy," Major Charles A. Flood on "Hepatitis," and Captain James Liebmman on "Kala-azar." Major Perk L. Davis presented a case of Hodgkin's disease.

\*By First Lieut. Louis Haber, Sn. C., A. U. S.

### AN IMPROVISED SLIT LAMP

Information concerning injured eyes can be obtained with a slit lamp, which cannot be obtained by other means. The degree of penetration of a foreign body into the cornea can be accurately determined. The location of blood vessels in relation to the layers of the cornea is readily made out and the depth of a corneal ulcer can be easily determined. The slit lamp reveals a smaller concentration of leukocytes in the anterior chamber than can be demonstrated by other methods; it is useful also in the examination of lens opacities and of exudates and deposits on the posterior surface of the cornea. The standard slit lamp has essentially five parts: a concentrated filament lamp, a condenser, an objective lens, a microscope, and a slit. The condenser focuses the image of the filament on the objective lens, which focuses the image of the slit on the cornea. The microscope furnishes an enlarged image of the cornea.

U. S. Army general hospitals are equipped with commercial slit lamps (Med. Dept. Item No. 3707700). In station hospitals where the volume of eye work does not justify having a regular slit lamp, and yet where the ophthalmologist is competent to treat any type of eye inflammation, an improvised slit lamp can be made which will be of especial value to the ophthalmologist, and will aid the less skilled medical officer in determining which cases should be transferred to a general hospital. An improvised lamp of the type illustrated was made in the field\* by Captain Joseph F. Dias, Jr., M.C., from materials readily at hand.

A 4-foot length of  $\frac{1}{2}$ -inch pipe set in a No. 10 can filled with cement provides a solid base. A bend in the lower end of the pipe adds to its solidity. The swivel joint shown in the illustration is made of three pieces of wood joined with screws, the first fitting into the lumen of the pipe, another forming the base of the lamp proper, and another joining the other two.

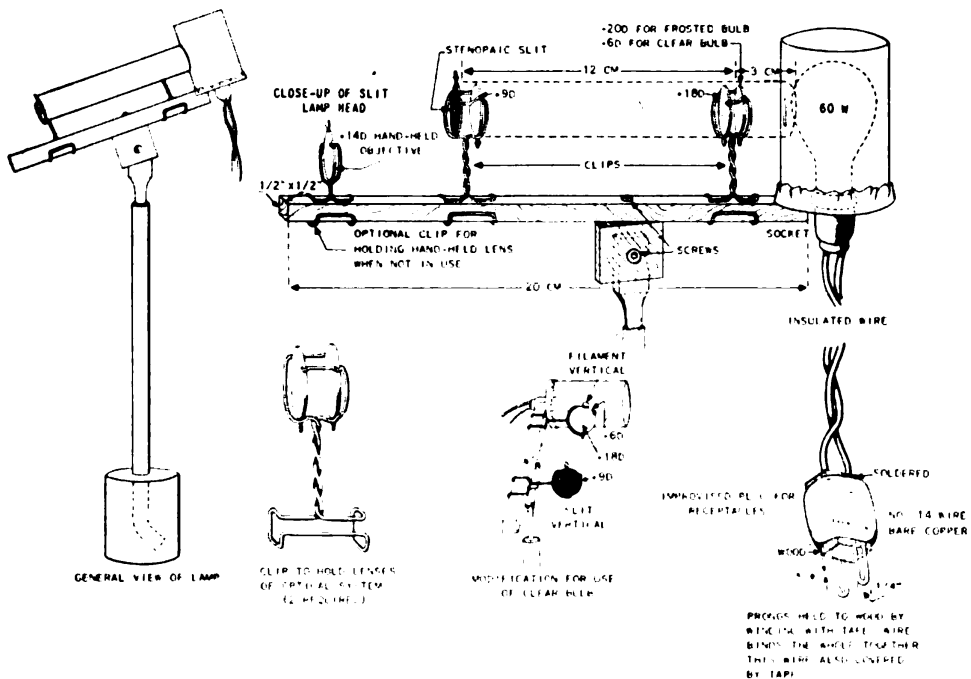
An ordinary bulb is the source of light. A 60-watt bulb is best, as it provides an adequate amount of illumination without excessive heat. The bulb must have a lamp housing in order to limit the light to the optical system. This housing is made from one or two tin cans. With a can with a friction top, the lamp socket may be mounted readily in the cover and the body of the can may be used for the lamp house. The same may be done with two cans which will fit one within the other, such as an evaporated milk can and a No. 2 can. The larger can is cut down to serve as a cover and its cut edge is crimped to provide a friction fit on the smaller can, which, of course, has one end entirely removed. A hole cut in the cover provides for the insertion of a sign socket; if a sign socket is not available, the ever-present weatherproof socket can be used and held in place by adhesive tape. The can cover is nailed to the base stick (0.5 inch by 0.5 inch) at its short end.

A hole is cut in the side of the lamp housing at the level of the lamp filament. If a frosted lamp is used, the opening should be about 3 mm.

\*The Medical Bulletin of the North African Theater of Operations, September 1944, page 59.

by 5 mm., with its long axis vertical, and placed close to the bulb surface. If a clear bulb is used, the opening may be 30 mm. in diameter and its distance from the bulb surface is immaterial; but the lamp house must have its axis horizontal, as illustrated, so the filament of the bulb will be in a vertical plane and edgewise to the optical system.

The lenses used are from the trial lens case (Med. Dept. Item No. 3090000) and they are held in position by spring clips bent from stiff 14-gage wire. The lens closest to the light is 3.5 cm. from its surface and is of plus diopter strength, while the one next to it is of plus 18 diopters. The third lens, at 12 cm. from the first two, is of plus 9 diopters. If a clear bulb is used, the first lens should be of about 6 diopters. In either case the light from the bulb should be concentrated into a band about 5 mm. wide at the center of the third or front lens. At this stage the lamp is complete for general or focal illumination.



For slit lamp illumination, a stenopaic slit from the trial case is placed in front of the third lens. If this lamp is now placed at a distance of about 66 cm. from the patient's eye, pointing directly at it, and a plus 14 diopter lens is hand-held 7 cm. from the eye and in line with the lamp, the sharp bright image of the slit formed at the eye may be used in the usual manner to obtain an optical section of the eye. Care must be taken to keep the hand-held lens at right angles to the optical axis; otherwise the image will be deformed. By placing a black paper diaphragm on the hand-held objective so that only the central 1.5 cm. portion of the lens is used, the image of the slit will be sharpened. The same lens is employed for focal illumination. The stray light is best controlled by joining the two lens clips with a tube of rolled black paper from a roentgen film. Slots are provided for the stems of the clips and the handles of the lenses. The length of this tube is 16 cm. The necessary magnification is obtained by the use of the Berger loupe. This magnification can be increased by a supplementary lens of 10 or 14 diopters from the trial case snapped into the end of the Berger loupe, if the loupe has a plastic frame.

### THE DEDICATION OF WAKEMAN FIELD

A new and larger demonstration area of the Department of Military Sanitation at the Medical Field Service School, Carlisle Barracks, has been constructed on land adjacent to the Barracks across the railroad. The demonstration area is more suitable for the needs of the school, is large enough to present all appliances and methods of value in maintaining the highest standards of



Mosquito control.

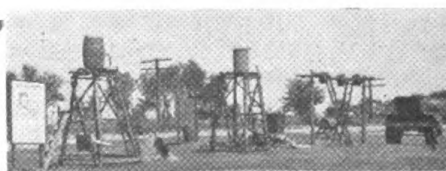


Mess sanitation.

health of our troops, and is intended to serve as a model sanitation demonstration area for the Army. It has been named Wakeman Field, after the late Colonel Frank B. Wakeman, M. C., who formerly served in the Department of Military Sanitation at Carlisle Barracks and was director of the Training Division of The Surgeon General's Office at the time of his death. The speakers at the dedication ceremonies on 11 October 1944 were Brigadier General Addison D. Davis, commandant, Medical Field Service School, Colonel H. T. Wickert, M. C., assistant commandant, and Brigadier General Russel B. Reynolds, director of Military Personnel, Army Service Forces. The directors of the Department of Military Sanitation since the



Human waste disposal.



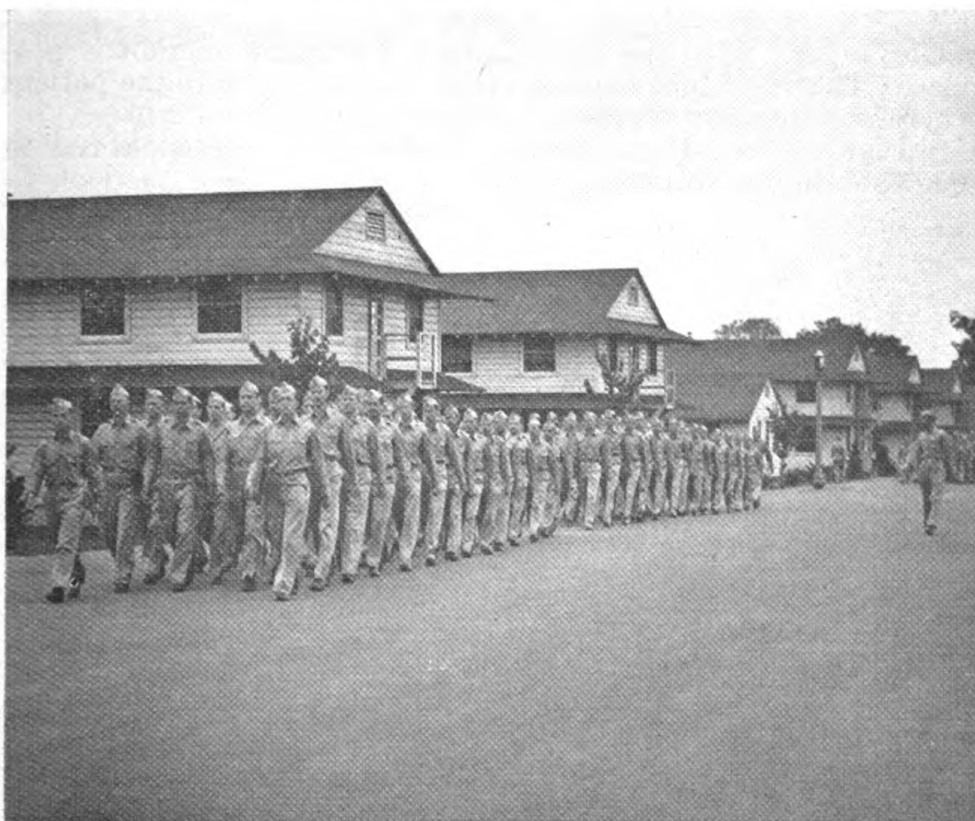
Personal hygiene and louse control.

school was established at Carlisle Barracks in 1920 have been: Major (now brigadier general) George B. Foster, Jr.; Major (now major general) Morrison C. Stayer; Major (now major general) George C. Dunham; Major (now colonel) Charles G. Souder; Lieut. Colonel (now major general) George F. Lull, the Deputy Surgeon General; Major (now colonel) Roger G. Prentiss,

Jr.; and the present director, Lieut. Colonel Marcus D. Kogel. The illustrations shown are only a few of the many appliances and methods available for demonstration in the new area.

#### LARGEST CLASS AT CARLISLE BARRACKS

The Medical Field Service School at Carlisle Barracks, Pennsylvania, on 17 November 1944 graduated the largest class of Medical Department officers which has been enrolled since the beginning of the present war. The nearly 1,000 officers completed six weeks of intensive training in field work, military hygiene and sanitation, preventive medicine, and other subjects necessary for the care of the sick and injured under war conditions. Brigadier General Frederick A. Blesse, Chief Surgeon, Army Ground Forces, Washington, D. C., gave the address; Brigadier General Addison D. Davis, commandant at Carlisle Barracks, presented the diplomas; and Colonel Howard T. Wickert, M.C., assistant commandant, gave the history of the school. The Medical Field Service School, which has been termed the West Point of the Medical Department, since its opening in 1920 has graduated nearly 26,000 Medical Department officers, and, in addition, many other thousands have attended the summer camp courses.



Student officers marching to class.



### SUCTION APPARATUS

An efficient portable suction apparatus which operates by being attached to the suction line of a vacuum-type windshield wiper on a motor vehicle can be easily assembled in the field from salvaged plasma set equipment. The parts needed are: (1) rubber tubing; (2) glass tubes, with cotton filter removed, which can be used as connectors for the several lengths of rubber tubing and as connection into the trap bottle; (3) empty 600 cc. bottles with rubber stoppers (standard plasma set bottles); (4) a standard suction tip which is available in the instrument set of the medical battalion's clearing company. An improvised adapter can be easily had by using a rubber catheter or a piece of glass tubing.

Figure 1, which is diagrammatic, shows one tube running from the trap bottle to the windshield wiper attachment on the intake manifold of any motor vehicle possessing a vacuum-type windshield wiper. With the motor idling, maximum suction is produced. The other tube extends from the trap bottle to the patient where the operator applies a suitable suction tip.

Figure 2 is a diagrammatic illustration of the apparatus in operation in one situation.

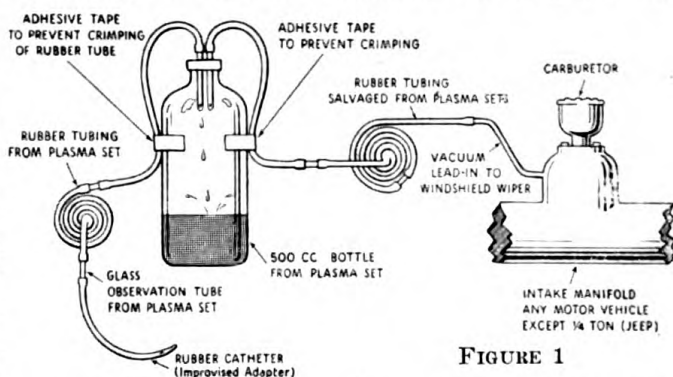


FIGURE 1

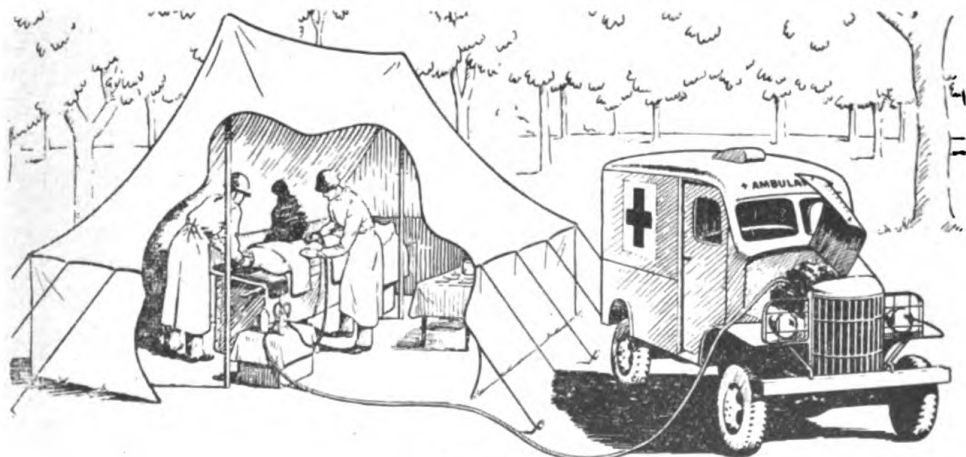


FIGURE 2

This improvisation was submitted almost simultaneously by Major Charles H. Wilson, M. C., and Major Bernard T. Daniels, M. C., of the Medical Field Service School, Carlisle Barracks, Pa., who state that the idea was first brought to their attention by Capt. Joseph E. Crisp, M. C.; and by Lieut. Colonel James P. Gill, M. C., from the Brooks General Hospital, Fort Sam Houston, Texas. The two descriptions vary only in minor detail. The illustrations accompanied the paper by Majors Daniels and Wilson.

Figure 3 shows the connection to the windshield wiper attachment of a standard 4 x 4,  $\frac{3}{4}$ -ton ambulance. The thick, hard rubber, windshield wiper tube (A) can be seen hanging free. The plasma set suction tube (B) is seen attached to the vacuum pipe (C) leading to the intake manifold.

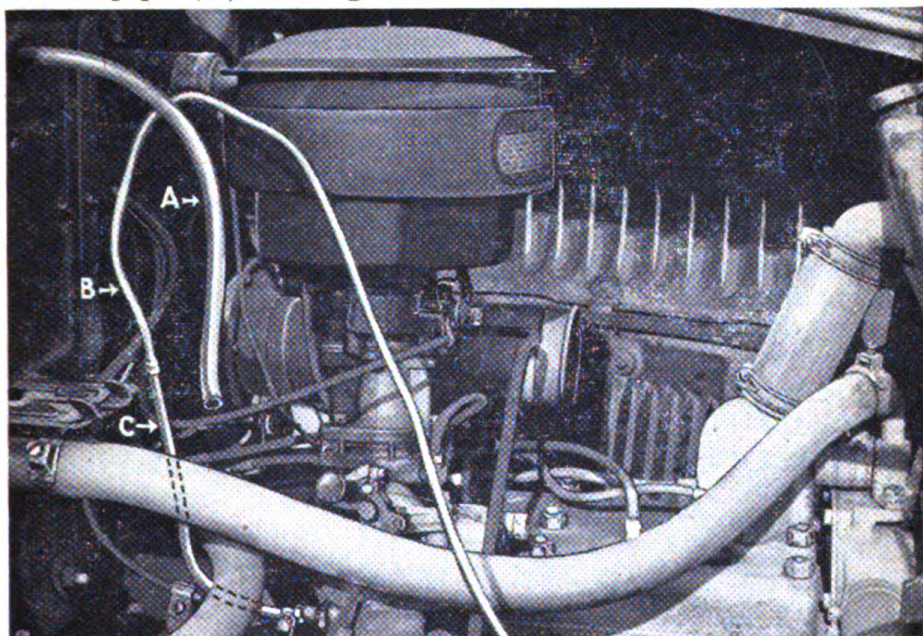


FIGURE 3

Several bottles with stoppers prepared (two glass tubes inserted through the stoppers of each) should be available so that as soon as one trap bottle becomes filled it may be replaced by another.

#### RETINAL DETACHMENT APPARATUS

The standard retinal detachment apparatus used in the Army and listed in the A.S.F. Medical Supply Catalog (1 March 1944) as Kit, eye surgery, Item No. 9363600, consists of an adapter with cord and chuck handle and appropriate electrodes for the surgical diathermy technique. It is used with the Electro-surgical unit, portable, Item No. 3670300, the latter being known as the Bovie Unit. The recommended technique is as follows: The adapter should be plugged in the "active electrode" pole and the "coagulating" and not the "scalpel" current should be used. The book of instructions put out by the manufacturer suggests power settings which have been found to be too high. The best results may be obtained by using the following outline:

<i>Electrodes</i>	<i>Power settings</i>
1 tip	15-18
1 isolated point	15-18
2 tips	20-22
6 tips	20-25

### GENERATOR SCREEN FOR LANTERN AND GASOLINE STOVE BURNERS

The operation of gasoline stoves and lanterns on leaded gasoline requires a replacement for the generator screen when the burners become inoperative. Steps have been taken to furnish sufficient generators with each burner for 240 hours' operation. It is still possible that a spare generator may not be on hand when needed. For such emergency the following improvisation is suggested to keep the burner in operation until replacement generators can be obtained: (1) Remove the generator from the burner. (2) Remove the screen, rod, and handle from the generator (see illustration). (3) Pack the space vacated by these

parts loosely with steel wool in the following manner: Select a piece of steel wool about twice the length of the generator. Fold it double and wash it in gasoline to remove loose short strands of steel. Then, with the aid of a match stick, pack the wool loosely into the generator, folded end first. Re-as-

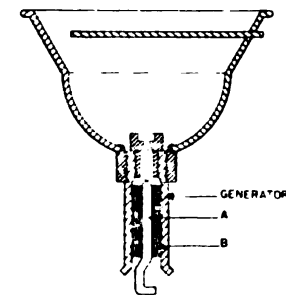
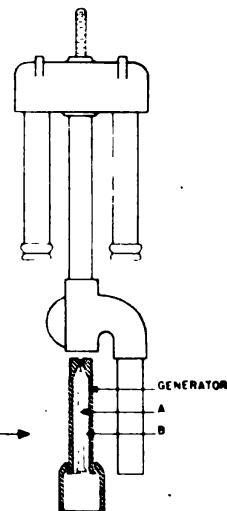


FIG. 1  
TYPE COLEMAN STOVE GENERATOR  
SHOWING PARTS REPLACED BY STEEL WOOL  
A—ROD AND NEEDLE  
B—SCREEN

FIG. 2  
TYPE GASOLINE LANTERN GENERATOR  
SHOWING LARGE GENERATOR  
PARTS REPLACED BY STEEL WOOL  
A—ROD AND NEEDLE  
B—FILLER



semble the generator. Do not replace the screen, rod, and needle, since it has been found that this procedure is unsatisfactory because of the strands of wool either being broken or the needle point foiled. Twelve hours of satisfactory operation should be possible following this operation. By frequent cleaning of the gas tip and replacing the wool with clean wool, the procedure can be repeated indefinitely.

When packing the large generators of old type gasoline lantern burners the steel wool should be packed moderately tight, and special attention must be given to prevent clogging the gas tip. Diligent cleaning is recommended. In cases of destruction of the needle point, the gas tip of the burner can be cleaned by using a small-size hypodermic stylet inserted through the gas tip. By rotating the tip around the wire, the tip can be cleared and the burner will then be satisfactory for operation.

From the Development Branch, Technical Division, Surgeon General's Office.

**The Salmon Lectures.**—Brigadier John R. Rees, consulting psychiatrist to the British Army, delivered the annual Thomas W. Salmon lectures at the New York Academy of Medicine, 20-22 November 1944. Following the lectures, he was a guest lecturer of the Salmon Committee in various cities throughout the United States.



#### POSTWAR PLANS FOR THE MEDICAL DEPARTMENT

The Surgeon General has appointed a committee to study and make recommendations concerning the Medical Department in the postwar Army. The chairman of the committee is the Chief of the Operations Service, and the recorder is the Director of the Special Planning Division. The committee is empowered to call on anyone within the Medical Department for suggestions. Various subcommittees have been appointed and are already working. As soon as security measures will allow, it is hoped that more definite statements can be made concerning the preparation of these plans and that the opinions of more individuals in the field may be incorporated in the final deliberations of this committee.

The committee is considering organization, training, medical supplies and equipment (including research and development), and personnel plans for the Medical Department of the postwar Army. Special consideration is being given to plans which it is believed will ensure the highest type of professional medical services to the Army. Specialization will be encouraged and this may include specialization in nonprofessional but related military medical subjects, such as command function in the field with troops, staff work, administration, or medical supply duties.

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#### THE LASKER AWARD IN MENTAL HYGIENE

The Albert and Mary Lasker Foundation, Inc., recently established an award to be given annually through the National Committee for Mental Hygiene for outstanding service in that field. Each year the award of \$1,000 will be made for distinguished service in some special aspect of the field of mental hygiene which is of current significance. The recipient of the award will be chosen by an anonymous jury, selected annually for its competence to judge accomplishment in a particular field.

At the annual meeting of the National Committee for Mental Hygiene in New York, 9 November 1944, the first Lasker Award was presented to Colonel William C. Menninger, M.C., A. U. S., director of the Neuropsychiatry Consultants Division of The Surgeon General's Office, for outstanding contribution to the mental health of the men and women of our armed forces. The citation read in part as follows: Colonel Menninger was already recognized before the war as one of the younger leaders in civilian mental hygiene through his work in Topeka, Kansas. He quickly revealed his stature as a soldier-physician when he became neuropsychiatry consultant to the Fourth Service Command, where, travelling from post to post, he stressed therapy of patients and brought in new concepts and methods. He was a

logical choice for the Chief of Neuropsychiatry in The Surgeon General's Office. Under his direction there, preventive psychiatry has been enhanced by a series of lectures on personal adjustment for all officers and enlisted men. Through his efforts the emphasis on diagnosis and disposition has been shifted to active treatment, retraining, and reconditioning for resumption of military duty or return to civilian life. To soldiers within his jurisdiction he has brought the collaboration of clinical psychology and, to a degree, psychiatric social work, and has assured to them internes and nurses strengthened by courses on psychiatry and neurology. He has collaborated with Selective Service in the improvement of the processes of selection.

The Committee further states that Colonel Menninger's use of scientific and lay publications and the radio has gone far to alleviate and correct public misunderstanding of this important subject.



Major General Norman T. Kirk, The Surgeon General, presents the Typhus Commission Medal to Brigadier General Leon A. Fox. (*The Bulletin*, November, 1944, page 40) Signal Corps photograph.



#### AWARD OF DISTINGUISHED SERVICE MEDAL

The War Department recently announced the award of the Distinguished Service Medal to Major General Morrison C. Stayer, U.S.A., 528 Paximosa Ave., Easton, Pennsylvania. While serving as Chief Health Officer, The Panama Canal, from September 1939 to February 1944, in the face of unprecedented difficulties, his untiring efforts and wise judgment resulted in the maintenance of exceptionally high standards in the Canal Zone and in the cities of Panama and Colon, and in the provision of adequate hospital facilities and personnel. His genius for organization proved invaluable to the Government. The manner in which he met all responsibilities placed upon him made possible greatly improved health conditions locally and played a large part in the outstanding results achieved in the field of health and sanitation. By his qualities as an officer, a very difficult situation dealing with standards of sanitation was handled in a superior manner. He rendered invaluable service in the recruiting of laborers from Central and South America for vital defense programs in the Caribbean Area.

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#### AWARD OF OAK-LEAF CLUSTER

The War Department has announced award of the Oak-Leaf Cluster to the Distinguished Service Medal to Brigadier General Edgar Erskine Hume, U. S. Army. The citation follows:

From 1 October 1943 to 15 December 1943 as chief of the Allied Military Government Section, Fifth Army, he successfully carried out one of the most extensive military government tasks ever accomplished by the United States, being charged with the government of Campania, a region of 6,000,000 inhabitants, including Naples, one of Italy's largest cities. He made detailed plans for the administration of Naples, which, under his orders, were put into immediate execution when the city was taken on 1 October 1943.

Despite enormous handicaps in Naples where the Germans had destroyed the water supply, electric power sources, drains, and other public utilities, had mined buildings, despoiled hospitals, dispersed the police, and in general paralyzed the civil administration, he was able by his unusual ability and devotion to duty to restore order forthwith and within a few weeks to return the city's functions almost to normal. A threatened epidemic of typhoid fever was averted by his wise preventive measures. Our victory was thus hastened as the Army commander was free to perform purely military functions without the added burden of civil government.

The respect in which this officer was held by the Italians, his intimate knowledge of the country, its people and language, and his rare administrative skill and leadership made him unique in his efficient handling of an extremely difficult and politically delicate task.

General Hume was awarded the Distinguished Service Medal for outstanding service as a medical officer during the World War and as Commissioner of the American Red Cross in Serbia after the war.

In the list of awards published in the October 1944 *Bulletin*, page 39 the abbreviation "M.C." followed the name of Captain David L. Beavers, of Apex, North Carolina. These letters should have been "D.C."

## RECENT DIRECTIVES AND PUBLICATIONS

This list is intended as only a brief reference to the items mentioned. Before acting on any of them, the original communication should be read and request for copies, when made, should be directed to the source of the communication through proper channels.

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|--|--|
| WD Circular No. 341<br>19 Aug. 44  | Relief from Duty. Sets forth policies and procedures to be observed in relieving from active duty officers over 38 years of age for whom no suitable assignments exist.  |
| ASF, Headquarters<br>Circular No. 272<br>24 Aug. 44<br>Part One, Sect. II              | Promotion. Sets forth policies and procedures relating to promotion of officers in A.S.F.  |
| ASF, Headquarters<br>Circular No. 274<br>25 Aug. 44<br>Part Three, Sect. VII           | Dental Officer. Provides that retention on active duty of D.C. officers found on hospitalization to be permanently disqualified for general service is not desired. Foregoing is not to prevent retention of combat wounded D.C. officers under current directives. Where action taken contrary to above since 25 May 1944, such cases will be reconsidered. |
| AR 40-1010<br>C 2<br>29 July 44  | Dental Records. Provides that a fracture will be diagnosed only once, wherever dental service was first initiated or condition first recognized in a military installation, and all subsequent diagnoses regardless of extent or type of treatment will be diagnosed as fracture, old.   |
| ASF, Headquarters<br>Circular No. 284<br>30 Aug. 44<br>Part One                        | Debarkation Hospitals. Sets forth reporting system which will make available information required to ensure prompt movement of patients evacuated from overseas, from debarkation hospitals, direct to medical installations having facilities for proper treatment and located near the locality of patient's preference.                                   |
| ASF, Headquarters<br>Circular No. 285<br>31 Aug. 44<br>Part Two, Sect. VI              | Military Personnel. Provides that combat-wounded personnel who voluntarily desire to remain in service will be retained if their physical condition permits useful employment. Efforts to persuade such personnel to remain in service will be discontinued. Lists several directives which are rescinded.   |
| ASF, Headquarters<br>Circular No. 285<br>31 Aug. 44<br>Part Two, Sect. VIII, IX, and X | Veterans' Administration. Sets forth policy and procedure for transfer of housekeeping and medical supplies and equipment physically located at posts, camps, and stations being made available for use of Veterans' Administration.   |
| AR 40-2090<br>C 1<br>30 Aug. 44  | Encephalomyelitis. To protect against equine encephalomyelitis, all Army horses and mules will be immunized annually with bivalent vaccine, administered intradermally, as directed by S.G. Vaccine to be made available by Army Veterinary School. Makes provisions re shipment of vaccine.   |
| ASF, Headquarters<br>Circular No. 296<br>9 Sept. 44<br>Part Two, Sect. VIII            | Installation. Camp Phillips, Salina, Kansas, placed in category of surplus installations as defined in W.D. Cir. No. 306, 1944.  |
| WD Circular No. 367<br>9 Sept. 44<br>Sect. II  | Amputation Centers. Patients with major amputations to be transferred to general hospitals designated as amputation centers. After separation from service, amputee will retain prosthesis, and subsequent repair or replacement is responsibility of  |

WD Circular No. 359  
4 Sept. 44

WD Circular No. 392  
2 Oct. 44  
Sect. II

ASF Headquarters  
Circular No. 335  
6 Oct. 44  
Part Two, Sect. II

AR 210-50  
C 2  
2 Oct. 44

WD Circular No. 393  
4 Oct. 44  
Sect. IV

ASF, Headquarters  
Circular No. 310  
16 Sept. 44  
Part Two, Sect. II

WD Circular No. 374  
14 Sept. 44  
Sect. II

WD Circular No. 375  
15 Sept. 44  
Sect. II

AR 40-1080  
C 3  
20 Sept. 44

**Veterans' Administration.** Makes provisions re furnishing prostheses to personnel who remain on active duty. Purchase or fitting of artificial limbs at Government expense is not authorized at other than amputation centers. Refers to par. 10d, AR 40-520.

**Salvage.** Requires submission of monthly salvage report, beginning with report for September 1944, by specified installations. Report to be prepared by such Class IV installations as are specified by chief of technical service. Sets forth instructions re preparation of such report.

**Psychologists.** A. G. authorized procurement objective, for appointment as second lieutenant, of enlisted men who are qualified clinical psychologists. Sets forth required qualifications.

**Laundry.** C.G.'s of service commands directed to establish at their headquarters a director of laundry service. Q.M. to assist service command headquarters in selecting qualified officer to fill position. Sets forth functions of director of laundry service.

**Nonappropriated Funds.** Changes AR 210-50, 1 June 1944. Adds "Book department funds at service schools" as authorized revenue-producing fund. Makes provisions re declaration and payment of dividends from funds. Provides that Board of Directors, Army Central Welfare Fund, will provide system of accounts for that fund.

**Nonappropriated Funds.** Amends W.D. Cir. No. 219, 1944. Defines "strength" for various funds. Strength for post hospital funds is number of authorized beds. Requires custodians of post trust funds to submit Consolidated Distribution Statement on 23d of each month.

**Medical Corps Officers.** Because of need of Medical Corps officers overseas, all such officers on duty in A.S.F. who are classified for permanent limited service will be brought before nearest disposition board authorized to determine fitness of officers for general service, limited service overseas or in U. S., or limited service in U. S. only. On completion of physical reclassification, disposition board report will be sent to A.G. through S.G., with copies to C.G., service command, and officer's C.O. Refers to W.D. Cir. No. 102, 1944, which establishes physical standards.

**Hospital Ship.** Provides that classified documents or material is not permitted aboard hospital ships except certain restricted documents as listed.

**Army Nurse Corps.** Provides that no nurses except student nurses scheduled to become registered within three months, will be authorized a physical examination unless certified as available by Procurement and Assignment Service.

**Statistical Health Report.** Provides that number of authorized beds at regional hospitals will be computed on basis of 3.5 percent of average strength of personnel for whom station hospital care is provided plus 0.5 percent of average strength of personnel for whom regional hospital care is provided.





Medical corpsmen of U. S. infantry unit in France dig out a soldier buried alive by dirt when enemy shells struck near his foxhole.



Two U. S. Army nurses board a Coast Guard-manned transport for the journey home after twenty-eight months of service in Asia. The shower fails to dampen their happiness. Coast Guard photograph.

## The Epidemiology of Epidemic Hepatitis

MAJOR GUY H. GOWEN\*

Medical Corps, Army of the United States

A study of about 400 cases of epidemic hepatitis in northern Tunisia, in the five months ending with January 1944, was based chiefly on observations among military personnel. Eighty-five percent of these were Americans, 12 percent were British, and 3 percent were civilians. Of the cases of epidemic hepatitis, reported from 1 June 1943 to 5 February 1944 to the surgeon of this base section, the fatality rate was 0.05 percent. The maximum incidence occurred during October and November 1943 in both military personnel and civilians.

### CLINICAL DESCRIPTION

The usual picture is that of gradual onset with fever, malaise, and anorexia. In 10 percent of the cases the onset was acute with chills, fever, and mild prostration.

With the development of the clinical disease, the characteristic symptoms are nausea, vomiting, right upper quadrant pain or distress, headache, and not uncommonly diarrhea. Icterus, when present, appears on an average of five days after the onset. While the fever may be as high as 104.2° F., the height of the temperature has no relation to the type of onset. With the advent of icterus the temperature rapidly drops to normal as a rule. Liver tenderness is a consistent finding and associated liver enlargement is common. Splenic tenderness and enlargement are less common. The red blood cell count and hemoglobin are usually normal. The leukocyte count usually shows a leukopenia, normal counts are common, and leukocytosis is rare. The differential blood count commonly shows a relative lymphocytosis, but not uncommonly is normal. Vacuolation of the nucleus and cytoplasm of the lymphocytes and monocytes are common. The icteric index may vary from 12 to 15 in subicteric cases to 220 in severe icteric cases.

The clinical course is not determined by the type of onset nor is the height of the icterus necessarily proportional to clinical symptoms. Hematuria may occur late, accompanied by transitory back pain. Usually however, there is uneventful and gradual recovery. The minimum period of hospitalization was 16 days, the maximum, 60 days, the average, about 30 days. The period of disability is established to be a minimum of 21 days, a maximum of 90 days, and an average of about 35 days. In some cases,

\*Now lieutenant colonel.



there is a repeated tendency toward relapse on returning to regular occupation and diet. The discharge of the patient is based on clinical recovery with diminution in the size of the liver plus the ability to tolerate a normal diet.

#### PATHOLOGY

In the cases studied at autopsy, the liver showed a diffuse process with marked destruction of parenchymal cells and accompanied by leukocytic and histiocytic reaction and infiltration.

Almost all of the fatal cases progressed rapidly with death occurring from 7 to 13 days after the appearance of jaundice; in one, the patient survived 44 days after the advent of icterus. In three cases there were intestinal lesions; one consisted of lymphoid hyperplasia and round-cell infiltration in the lower 30

cm. of the ileum; in another case, in the colon and especially in the cecum, were small, shallow, nonindurated, ulcer-like lesions about  $\frac{1}{2}$  mm. in diameter; in the third case the mucosa and submucosa of the colon were edematous and heavily infiltrated with polymorphonuclear

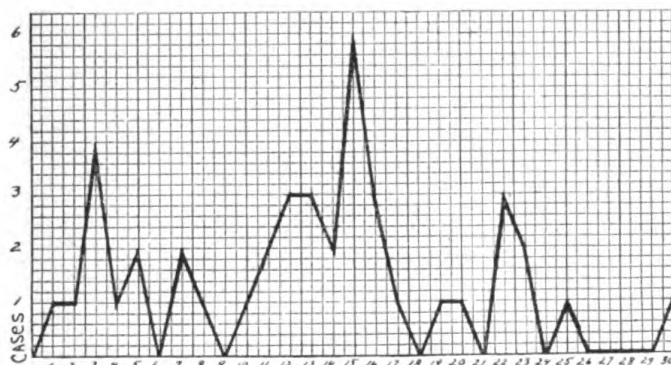


CHART 1. Daily case incidence in September in organization "Q."

leukocytes. In one large area in the submucosa an abscess had formed. These findings were interesting because of the suspicion that the intestinal tract may be a point of localization of the organism causing epidemic hepatitis.

#### INCUBATION PERIOD

In twelve instances there had been significant contact with pre-existing cases. Eight were tentmates with known cases, three worked in an office with known cases, and one lived in a house with a known case. Assuming these twelve persons acquired the infection by intimate contact with known cases, the incubation period would vary from 7 to 38 days with an average of 17 days.

#### SOURCE OF INFECTION

The spread of the disease could not be accounted for solely on the basis of contact with cases of icterus. There was seldom a history of such contact. The reservoir being apparently in humans, this would lead one to presuppose the existence of sub-icteric cases. Following are the results of an attempt to demonstrate the presence of such cases.

1. *Inapparent cases.* By this is meant individuals without apparent symptoms or with very mild transient symptoms whose icteric index or bilirubin determination was above normal. These were discovered by survey. In a random sample of 253 blood specimens among five organizations in which cases of icterus were occurring, 9 instances were found in which the icteric index or bilirubin determination was above normal. None of these individuals developed jaundice. The icteric index varied from 10 to 16 and the one bilirubin determination was 1.6 mg. percent which is about equal to an icteric index of 16. In a random sample of 71 blood specimens among three organizations having no cases of jaundice, no elevation of the icteric index above normal was found.

2. *Subicteric cases.* These were individuals with definite and typical symptomatology, an elevation of the icteric index or bilirubin above normal, but no clinical jaundice.

Seven cases were found. The symptoms were typical and the icteric index varied from 12 to 24. None of them developed jaundice. In most of these persons recovery was rapid, but in one instance the patient was sick about two weeks.

3. *Ratio of nonicteric to icteric cases.*

*Organization E.*—Using the icteric index as an indicator of infection without jaundice, 146 members of this unit were sampled. Of seven who had an icteric index above normal, five were found from 27 October to 30 October. During the week ending 30 October, two cases of jaundice were reported. This would make a ratio of 5 nonicteric cases to 2 icteric cases. The other two nonicteric cases were discovered on 6 November. For that week 4 cases of jaundice were reported, making the ratio of nonicteric to icteric cases 2 to 4. For the two-week period the ratio would be 7 nonicteric to 6 icteric. The strength of the organization was 1,054 and, since only one-seventh of the unit had been sampled, the potential number of cases without jaundice would be 49. This would give a final ratio of nonicteric to icteric cases of 8 to 1.

*Organization L.*—In this unit at the end of December a survey was made based on the common symptoms of epidemic hepatitis—anorexia, weakness, nausea, epigastric distress or pain, and headache. The two periods selected for comparison were May, June, July, and August, when there were few cases of jaundice, and September, October, November, and December, when large numbers of cases occurred. The unit strength was 56. Nine persons were eliminated for the reason that two had had jaundice, two were subicteric cases, one had migraine headaches, and four had had illness unrelated to hepatitis. The final tabulation therefore considers only 47 individuals. In analyzing the data 14 persons were found having one or more of these symptoms when jaundice cases were at a maximum as compared to three persons during the period preceding the high incidence of jaundice.

The frequency of occurrence of the symptoms among the three affected during the period May to August and the 14 affected during the period September to December follows:

There appears to be a significant difference between the two periods as to frequency of occurrence of symptoms and the number of persons affected. While no icteric index determinations on these individuals were made, it is reasonable to speculate that they had received subclinical doses of

	Times present	
	May - August	Sept. - Dec.
Anorexia	1	7
Weakness	2	6
Epigastric distress or pain	1	10
Nausea	1	7
Headache	3	10

the infective agent. There were two cases of icterus and two proved subicteric cases in this organization. If the 14 discussed are considered as possible inapparent cases, the ratio of non-icteric to icteric cases would be 8 to 1. On the basis of finding in the two organizations an apparent ratio of 8 to 1 in nonicteric to icteric cases, it would be concluded that of all individuals infected only about 11 percent develop icterus. The source of infection would appear to be primarily the inapparent and sub-icteric cases.

#### PERIOD OF COMMUNICABILITY

In cases of icterus the period of greatest communicability is believed to be the prodromal stage before the appearance of jaundice plus possibly a few hours after its appearance. The reason for this assumption was the experience among the personnel of a hospital to which over 200 cases of jaundice had been admitted. It was noted that cases of jaundice did not occur among the attending staff of the so-called jaundice wards, whereas 5 cases occurred among the attending staff of the surgical wards and 3 cases among the staff of the nonjaundice medical wards. It is known that frequently a case of epidemic hepatitis, before the appearance of icterus, may simulate an acute surgical condition of the abdomen, and so the temporary deposition of such cases in surgical wards would be inevitable. It is also known that other early cases may temporarily be classed as fever of undetermined origin and consequently would be initially admitted to nonjaundice medical wards.

The personnel of the surgical and nonjaundice medical wards therefore were coming in contact with early cases, whereas the personnel in the jaundice wards did not come in contact with cases until icterus was evident. The disease would have to be most highly communicable during the pre-icteric stages to explain this sequence of events since the factors of contact were the same in all of these wards.

An opinion on the period of communicability of the sub-icteric and inapparent cases would be highly speculative. In the former it is probably for the duration of the acute clinical symptoms, and in the latter for only a short period of time.

## DEGREE OF COMMUNICABILITY

That the invasive power of the infectious agent varies is indicated by studies in organizations designated "E," "H," and "Q." The morbidity rates for these units show that the attack rate of organization "Q" was almost three times that of "H" or "E." The morbidity rate per 1,000 for unit "Q" was 107; for unit "H," 38; and for unit "E," 35.

TABLE I

Month	Organization		
	"Q"	"H"	"E"
June	0	—	1
July	0	—	5
August	0	—	1
September	45	0	10
October	—	11	10
November	—	11	7
December	—	4	2
Total	45	26	36

The chronological dispersal of cases is given in table I. Organization "H" did not arrive in Tunisia until 4 September 1943 and organization "Q" left the area during the first week

of October. Chart 1 shows the daily incidence of cases in organizations "Q" during September.

If the ratio of 8 to 1 of nonjaundice to jaundice cases is considered, the picture would be as follows:

Unit	Strength	Jaundice cases	Potential nonjaundice cases	Nonjaundice case rate per 1,000
"Q"	420	45	360	854
"E"	1,054	37	296	280
"H"	671	26	208	309

In organization "Q" in which the spread was rapid the rate of potentially infective persons is thus found to be almost 4 times that of "E" and about  $2\frac{1}{2}$  times that of "H."

However, the cases in "Q" occurred within one month, whereas in "E" they were spread over eight months and in "H" over three months. If the month of highest incidence for these latter two organizations is selected a recomparison made accordingly, the following is true:

Unit	Strength	Jaundice cases in specified month	Potential nonjaundice cases	Nonjaundice case rate per 1,000
"Q"	420	45 in Sept.	360	854
"E"	1,054	10 in Sept.	80	75
"H"	671	11 in Oct.	88	130

The differences here are even more striking, and the picture is more representative of actual occurrence. Now the rate of nonjaundice cases in "Q" becomes 11 times that of "E" and 6 times that of "H." Using the same figures in terms of dissemination, the potential rate of spread of the infecting agent in "Q" in the same period of time was 11 times greater than in "E" and 6 times greater than in "H."

In terms of dosage, therefore, in one month in "Q," we find 96 percent of the total organization infected, in "E," 8.5 percent, and in "H," 14 percent.

#### MODE OF TRANSMISSION

These studies produced nothing to indicate transmission from lower animal to man either directly or indirectly and there was no evidence suggesting biting Arthropoda as possible vectors. Apparently the etiological agent is peculiar to man and passes from one person to another by direct and indirect contact. Whether the organism enters the body by the upper respiratory or the gastro-intestinal tract is not definitely known. The following evidence suggesting the gastro-intestinal tract was accumulated:

1. The seasonal incidence is compatible with the time of occurrence of acute enteric diseases.

2. The rising case incidence during warm weather and the decline with cold weather coincides with the rise and decline in fly population.

3. The symptoms are typically gastro-intestinal in nature.

4. In about 18 percent of the cases studied, diarrhea was associated with the onset of illness.

5. Of the 5 fatal cases studied, 3 had intestinal lesions of an acute inflammatory nature.

In further support of this conception is the report of jaundice in human volunteers following oral ingestion of duodenal washings from cases of spontaneous icterus<sup>1</sup> and the report of the cultivation of a virus from the duodenal contents of patients with epidemic hepatitis.<sup>2</sup> If the gastro-intestinal tract is the portal of entry, then the mode of transmission becomes that of other acute communicable enteric diseases. The manner of spread of epidemic hepatitis observed could be explained on this basis. A blood stream invasion is suggested by the type of liver pathology in humans and by findings in guinea pigs following the intraperitoneal injection of whole citrated blood from human cases of epidemic hepatitis.

#### EPIDEMIC HEPATITIS AMONG CIVILIANS

The following discussion is based on personal observation and information obtained from medical personnel in civilian practice, in the French Army, the French Marine Hospital Service, and the Tunisian Public Health Service.

1. Catarrhal and Human Serum Jaundice (editorial), J. A. M. A., 122:746, 10 July 1943.

2. Siede and Luz: Klin. Wschr., 23 Jan. 1943, quoted in Bull. Hyg., Lond., 18:361, May 1943.



There was general agreement that 1943 was the first time such an outbreak of jaundice had occurred in the Bizerte-Mateur-Tunis area. An epidemic of this type developed among French soldiers in southern Tunisia in 1939 and among German soldiers from December 1942 to February 1943, but civilians were not involved. Sporadic cases had occurred in the past. The disease was widespread, involved all social classes, and was equally distributed among the Arabs and French. Among the cases observed during the present study, the ages varied from 1½ to 54 years with no apparent preponderance of one sex over the other, and the clinical picture and seasonal distribution coincided with that noted among the military personnel.

#### LABORATORY STUDIES

Blood smears, blood cultures, stool cultures, darkfield examinations of blood and urine showed nothing of etiologic significance.

*White mouse inoculations.* Intraperitoneal injection of 20 mice with fecal filtrates, blood serum, duodenal content filtrates from acute cases and liver, brain, and spinal fluid filtrates from a fatal case of epidemic hepatitis gave uniformly negative results. Sixty to ninety days were allowed to elapse before the mice were killed and autopsied.

*Guinea pig inoculations.* Guinea pig No. 1 received 3 cc. of sterile citrated whole blood intraperitoneally from a case of epidemic hepatitis of about two weeks' duration. Twenty days after inoculation the animal was killed by ether anesthesia and autopsied. No gross pathology was found. Two areas of liver showed small round-cell infiltration and some degeneration of liver cells. Guinea pig No. 3 received 3 cc. of sterile citrated whole blood intraperitoneally from a case of epidemic hepatitis of about two weeks' duration. One day after inoculation the white count was 10,300; five days after inoculation it was 9,250; 20 days after inoculation it was 8,900; and 25 days after inoculation it was 7,400. Twenty-seven days later 4 cc. of sterile citrated whole blood were drawn from pig No. 3 and injected intraperitoneally into pig No. 16. Pig No. 3 was then killed and autopsied. No gross pathology was found. One focus of small round-cell infiltration with central degeneration of nerve tissue in the brain was found. Seventeen days after inoculation 4 cc. of sterile citrated whole blood were drawn from pig No. 16 and injected intraperitoneally into pig No. 17. When pig No. 16 was killed and autopsied, neither gross nor microscopic pathology was found. Thirty-one days after inoculation pig No. 17 was killed and autopsied. The left lobe of the liver showed one light brownish-red area 0.75 by 0.125 mm. The middle lobe showed two similar areas 0.125 by 0.125 mm. Microscopically multiple foci of degeneration with some infiltration were found. One cc. of sterile citrated whole blood from pig No. 17 was injected intraperitoneally into mouse No. 26 which was killed and autopsied 24 days later with negative results.

Guinea pig No. 2 received 3 cc. of sterile citrated whole blood intraperitoneally from a case of epidemic hepatitis of about two weeks' duration. Twelve days prior to injection this animal had a white count of 14,850. Five days after injection the white count was 4,300; 20 days after injection it was 9,600, and 25 days after injection it was 10,800. Twenty-five days after injection 4 cc. of sterile citrated whole blood were drawn from pig No. 2 and injected intraperitoneally into pig No. 15. Pig No. 2 was then killed and autopsied, and no gross nor microscopic pathology except a few petechial hemorrhages in the grey matter of the brain was found. Pig No. 15 was killed and autopsied 18 days after inoculation. Grossly the left

lobe of the liver showed a light brownish-red area along the anterior margin 1 by 0.5 cm. The two small caudate lobes were completely involved and had a similar appearance with mottling. Microscopically the tissue showed areas of multiple foci of necrosis.

#### DISCUSSION

The presence of a spirochaete was not demonstrated by blood smear, darkfield examination, special staining of tissues from inoculated animals or from fatal human cases of epidemic hepatitis. Repeated fecal culture failed to demonstrate as present any member of the typhoid-paratyphoid-dysentery group. Blood smear did not show the presence of any atypical malarial plasmodium.

The pathology found in pig No. 1 might be of a parasitic nature, but in pigs No. 15 and No. 17 it is felt to be more significant. In only three instances was animal passage attempted, and in two of them (pigs No. 15 and No. 17) liver pathology was found. Either the infective agent from human cases was transmitted through these animals, or an infective agent found in guinea pigs was transmitted to subsequent animals. Lack of animals made a control series impossible. If these lesions in guinea pigs are due to the organism causing epidemic hepatitis in humans, its presence in the blood stream of human cases and its viability would be indicated. The significance of the brain lesions in pigs No. 2 and No. 3 is not known. In 15 other guinea pigs injected intraperitoneally with either sterile citrated whole blood or sterile blood serum from acute cases, no pathology was found.

#### SUSCEPTIBILITY AND IMMUNITY

From this experience with military personnel and civilians, patients were seen from 1½ to 54 years of age. Predilection for particular age groups was not apparent, nor was any racial influence. No evidence was found of case incidence in one sex significantly predominating over that in the other sex. In a military hospital group, 4.4 percent of the female personnel were affected as compared to 3.9 percent of the male personnel.

The findings would indicate that arsenical therapy predisposes to the occurrence of epidemic hepatitis. In organization "E" the incidence of epidemic hepatitis among syphilitics who were receiving or had recently received arsenotherapy was 20 times the incidence among the other personnel. In another organization, the incidence among the syphilitics was 7 times that among the other personnel. Possibly atabrine has a predisposing effect in a few individuals. The epidemic of jaundice certainly was not directly due to the taking of atabrine. This outbreak was not due to yellow fever vaccine. Nothing was found to support the theory that this outbreak was due to an atypical type of fever parasite. No cases seen in this study had been subjected to either blood or plasma transfusion.

Epidemic hepatitis and war apparently go hand-in-hand. Those components of war that could be considered as favoring

the spread of such a disease are sanitary disruption, fatigue, dietary deficiencies, overcrowding, and mass movements of troops and civilians. In this instance all of these factors undoubtedly played a part. No evidence of an occupational effect was found.

Among 205 cases on whom complete histories were obtained in only nine had there been a previous attack of jaundice. Three of these were apparently relapses of a primary attack of epidemic hepatitis a few weeks previously. Two resulted during the outbreak in the United States ascribed to yellow fever vaccine. One patient who became ill in November 1943 gave a history of previous attacks in July 1942 and January 1943. The three others gave a past history of jaundice eight, ten, and nineteen years previously. In a random sample of 205 normal individuals we found ten who gave a history of jaundice varying from a few weeks to several years previously. It would seem that previous attacks of jaundice had no influence on the attack rate in 1943.

A rather general susceptibility to this disease seems apparent. The duration of immunity in cases that occurred during the present outbreak is open to question until there is another similar exposure period.

#### PREVENTION

On the basis of present knowledge nothing can be suggested other than careful attention to accepted sanitary procedures. In view of the apparent existence of many cases without icterus, isolation of frank jaundice cases would have no appreciable effect on the spread of the disease.

#### SUMMARY

1. The highest incidence of cases occurred during October and November 1943.

2. The findings indicate that the disease is caused by a viable agent which may be highly communicable but possesses only a mild degree of communicability. Apparently the icteric cases are most highly communicable during the prodromal stages preceding the onset of jaundice.

3. The etiologic agent is unknown.

4. The incubation period based on these observations is from seven to thirty-eight days.

5. The onset may be acute with chills, fever, and mild prostration, but is usually gradual with fever, malaise, and anorexia. Subsequently there is the development of nausea, vomiting, right upper quadrant pain, headache, and not uncommonly diarrhea. Liver tenderness was a consistent physical finding.

6. The pathologic picture is essentially that of a diffuse process accompanied by liver cell necrosis, leukocytic and histiocytic reaction, and infiltration.

7. The spread of the disease appears largely due to sub-icteric and inapparent cases.

8. The ratio of cases without jaundice to cases with jaundice appears to be about 8 to 1.

9. The evidence obtained favors the gastro-intestinal tract as being the portal of entry for the infecting organisms with the usual modes of transmission common to acute communicable enteric diseases. Little was found to favor the respiratory theory, but little was found to oppose it.

10. Susceptibility seems to be general. Arsenotherapy apparently lowers the threshold of resistance and favors infection. The theories that yellow fever vaccine or serum injections are responsible for this outbreak are not tenable on the basis of the cases studied.

11. The causative agent is widespread and has had an endemic existence for many years. There is reason to believe that cases of so-called "catarrhal jaundice" seen in the past have probably been what is now termed epidemic hepatitis. War has repeatedly enhanced the spread of communicable diseases. It seems reasonable to consider epidemic hepatitis in the same light.



Medical Corps men search for signs of malaria-bearing mosquitoes, Panama. 11 December 1942. Signal Corps photograph.

## Totaquine in the Treatment of Malaria

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During the eleven-week period ending 2 March 1944, a controlled study was undertaken at the 31st Station Hospital in a foreign theater to evaluate the efficiency of totaquine in the treatment of malaria.

A field artillery battalion recently returned from a malarious zone furnished the cases for this study. Atabrine suppressive therapy had been discontinued in this group for variable periods of time prior to the period of observation. The battalion numbered 511 officers and men, about 40 percent of whom had been added as replacements after July 1943. Two-thirds of those who developed malaria had been in the malarious zone since January 1943. During the eleven weeks a total of 304 cases were hospitalized, a rate of 2,814 cases per 1,000 per year; 165 individuals were affected, with 112 of these relapsing once (68 percent), and 27 relapsing twice (16.4 percent). Of the 165 individuals, 109 gave histories of previous malarial attacks confirmed by battalion medical records, and 56 gave no history of previous malaria. Specific therapy had not been instituted for the existing attack in any case prior to hospitalization. One death occurred in the series—a soldier who had been treated for his initial attack with quinine but who, on the second day of his first relapse, suffered a spontaneous rupture of the spleen. Splenectomy was performed but the patient died on the third postoperative day.

TABLE I  
*Months in malarious zone—165 individuals*

Months	Number
11	113
10	21
8	14
7	5
6	4
5	3
4	3
2	2
<b>Total 165</b>	

For the purpose of evaluating the efficiency of totaquine, the first 240 cases were treated in rotation, 80 cases being treated with totaquine, quinine, or atabrine. The dosages of totaquine and quinine employed were the same, viz., that recommended in S.G.O. Circular Letter No. 153, 19 August 1943: 1 gm. three times daily after meals for two days, followed by 0.6 gm. three times daily after meals for five days. Atabrine was given in the dosage prescribed in the same circular letter; viz., 0.2 gm. every six hours for five doses followed by 0.1 gm. three times a day after meals for six days.



Strict control of therapy, observation of patients, and recording of data have been maintained to eliminate variables as far as possible. The dosages of drugs noted were rigidly maintained and patients treated in rotation, regardless of symptoms or whether the attack was initial or a relapse. The nursing personnel during the period of study was relatively constant and very adequate; patients were closely observed by the nurse when swallowing medications; vomited doses were repeated, so that no single dose was missed. All histories, physical examinations, and daily observations were made and recorded personally.

Totaquine is composed of several alkaloids extracted from cinchona bark. Assay of the lot used in this study is as follows:

Cinchonine .....	26.9%
Quinine and cinchonidine .....	
Quinine .....	9.6%
Cinchonidine .....	31.2%
Quinidine .....	5.3%
Anhydrous quinine .....	9.6%
Total anhydrous crystallizable cinchona alkaloids...	73.0%

Evaluation of its effectiveness has been made by comparing its action in causing disappearance of parasites from the blood, its effect on fever and symptoms, its toxic effects, and the number of relapses occurring after its use and the intervals at which they occurred, with similar actions and effects of quinine and atabrine.

#### SPECIES DIAGNOSIS AND EFFECT OF THERAPY IN CAUSING DISAPPEARANCE OF PARASITES FROM THE BLOOD

The thick-film technique was used for all blood smears examined, and Field's stain was employed exclusively for staining. Routine smears were obtained on admission and were repeated daily if negative until a positive report was returned. In no instance in the series was therapy started before a laboratory confirmation of the diagnosis had been made. Once

TABLE II  
*Species distribution in initial attacks and relapses, 304 cases*

	<i>P. vivax</i>	<i>P. falciparum</i>	Mixed
All cases (304)	268	15	21
Initial attacks (165)	131	15	19
First relapses (112)	110	0	2
Second relapses (27)	27	0	0

TABLE III  
*Average day of therapy on which smears were first negative*

Drug	Average day
Totaquine	2.73
Quinine	2.53
Atabrine	2.25

therapy had been started, daily morning smears were examined until at least two successive negatives were obtained. In addition, smears were examined on the last day of therapy. The species diagnoses of the cases are noted in table II. For purposes of comparison, the day of therapy on which blood smears were first reported as negative was listed for each case and

the average of these days determined for the 80 cases treated with each of the drugs. Table III shows that the average day for totaquine is slightly greater than that for quinine and atabrine. In the light of other effects of the drug, this fact is probably of little importance.

#### EFFECT OF THERAPY ON FEVER AND RAPIDITY OF RESPONSE

The effectiveness of totaquine in bringing about subsidence of fever was compared with the effect of quinine and atabrine in this regard. Temperatures were taken on all patients at four-hour intervals. The day of therapy on which patients were first permanently afebrile was noted for each case and the average of these days obtained for the 80 cases treated on each drug. Table IV shows that the average is nearly the same for totaquine and quinine, the time for atabrine averaging about one-half day longer.

TABLE IV  
*Average day of therapy on which patients were first permanently afebrile*

Drug	Average day
Totaquine	2.2
Quinine	2.25
Atabrine	2.7

#### THE EFFECT OF THERAPY ON SYMPTOMS AND RAPIDITY OF RESPONSE

To compare the effectiveness of totaquine with the other drugs in alleviating symptoms, the day on which patients first offered no complaints was noted and the average determined for each group of 80 cases (table V). Little difference is noted among the three groups of cases in this effect. Totaquine, like quinine, did, however, tend to reduce more promptly the severity of the malarial symptoms than did atabrine, although the time at which patients were entirely free from symptoms was about the same, regardless of which drug was used.

TABLE V  
*Average day of therapy on which patients were first free from malarial symptoms*

Drug	Average day
Totaquine	3.68
Quinine	3.7
Atabrine	3.53

#### TOXIC EFFECTS

A careful attempt was made to record all symptoms which were attributed to drug toxicity rather than to the malaria itself or to other organic or psychic factors. Complaints registered with the nurse and recorded in the nurse's notes, spontaneous complaints made to the ward officer on daily rounds, and other symptoms elicited by indirect questioning were evaluated and recorded. The duration of each of these complaints was noted and averaged for all cases (table VI). The most striking single feature is the high incidence of side effects in those patients treated with totaquine and quinine as compared with the low incidence in the atabrine-treated

group. Of 80 cases treated with totaquine, only 9 did not offer complaints attributable to the drug. All but one of the quinine-treated cases complained of one or more toxic symptoms, whereas only 7 cases treated with atabrine had toxic symptoms.

Little difference is noted in the incidence of toxic symptoms for the groups treated on totaquine and quinine, but of all toxic symptoms observed the most distressing were nausea and vomiting accompanying totaquine therapy. In several instances these were severe and necessitated frequent repetition and spacing of vomited doses, and in one case it became necessary to stop the drug entirely because of inability to retain it. Vomiting was usually marked only on the first day. Cases of vomiting prior to institution of therapy were for the most part excluded unless the vomiting seemed to bear a clear-cut relationship to ingestion of the drug. The very high incidence of nau-

sea is noted in table VI, the average duration of this symptom being about a day and one-half. None of the side effects of totaquine persisted as long as the tinnitus and deafness incident to quinine therapy, there being few side effects noted during the last half of the

TABLE VI

*Toxic symptoms; frequency and average duration; 80 cases treated on each drug*

Symptom	Totaquine		Quinine		Atabrine	
	Cases	Days	Cases	Days	Cases	Days
Nausea	70	1.6	16	1.6	4	3.5
Vomiting	32	1.1	6	2.3	1	2.0
Tinnitus	7	1.7	75	3.0	0	0
Deafness	0	0	50	2.8	0	0
Blurring of vision	8	1.0	0	0	0	0
Vertigo	24	2.3	8	2.7	0	0
"Nervousness"	0	0	0	0	2	3
Generalized urticaria	1	0	1	1	0	1
Headache after each dose	1	7	0	0	0	0

treatment with totaquine. The complaint of blurring of vision in 8 cases treated with totaquine occurred as a transitory symptom of a day's duration or less, was noted chiefly for near vision, and occurred most frequently on the second or third day of therapy. "Vertigo" was described as a feeling of "lightheadedness" and a tendency to fall when standing, with occasional rotation of surrounding objects, which, as with blurring of vision, occurred usually on the second and third day. The exact relation of this symptom to totaquine is not known, but it was noted only in the group of cases treated with this drug. General urticaria occurred on the first day of therapy in one case treated with totaquine and in one treated with quinine. In the former, the patient had a known sensitivity to quinine which he had failed to report prior to starting therapy. The latter was a patient who had been treated

once previously with totaquine without experiencing this type of reaction. In both, the urticaria was universal, accompanied by intense itching, and subsided quickly after administration of adrenalin. In both, the therapy was discontinued and atabrine substituted. One patient complained of headache coming on usually one-half hour after taking totaquine and lasting for two or three hours. This complaint was noted with unfailing regularity throughout the week's treatment and stopped promptly on cessation of the drug. After 80 cases had been treated with totaquine alone in the doses noted,

TABLE VII  
*Uncorrected malaria rates based on total strength (511), for eleven weeks.*  
(Rates per 1,000 per annum)

Week	Total cases	Initial attacks	First relapses	Second relapses
1	2,915	2,915	0	0
2	2,134	2,134	0	0
3	3,454	3,377	99	0
4	4,158	3,069	1,122	0
5	1,925	1,012	913	0
6	4,387	1,826	2,552	0
7	2,651	1,122	1,309	198
8	2,024	198	1,617	198
9	2,860	506	1,617	715
10	2,134	198	1,309	594
11	2,233	407	814	1,012

a few cases were treated with doses of 0.6 gm. three times daily after meals coincidentally with atabrine. This smaller initial dose was accompanied by less frequent vomiting and less severe nausea than had occurred in those given the higher initial dose, but the number so treated is too small to draw conclusions as to side effects and results.

TABLE VIII  
*Intervals between attacks*  
*80 cases treated on each drug*

Drug	Average interval all cases	
	Cases	Interval
Totaquine	52	13.7
Quinine	56	15.2
Atabrine	31	37.4

#### RELAPSES AND INTERVALS BETWEEN INITIAL AND SUBSEQUENT ATTACKS

Weekly rates for the total number of cases hospitalized, for initial attacks and subsequent relapses, are found in table VII. It is recalled that a total of 304 cases were hospitalized, 165 being initial attacks; 112 (68 percent of initial attacks) relapsed once and 27 (16.4 percent of initial attacks) relapsed twice. The weekly rates in table VII are computed regardless of the therapy. It will be seen on chart 1 that the curve representing first relapses crosses that representing initial attacks between the fifth and sixth weeks. That this event does not occur later is felt to be due in large part to the early recurrence in patients treated with totaquine and quinine as compared to the later recurrence in atabrine-treated patients.

When the number of relapses and the intervals separating them from previous attacks are considered in the light of

the therapy employed, similarity between totaquine and quinine and rather marked differences between these two drugs and atabrine are again noted. Table VIII shows that of the 80 cases treated with totaquine, 52 (65 percent) relapsed during the period of observation following this therapy; of those treated with quinine, 56 (70 percent) relapsed in this time; whereas, of those treated with atabrine, 31 (38.7 per-

CHART 1

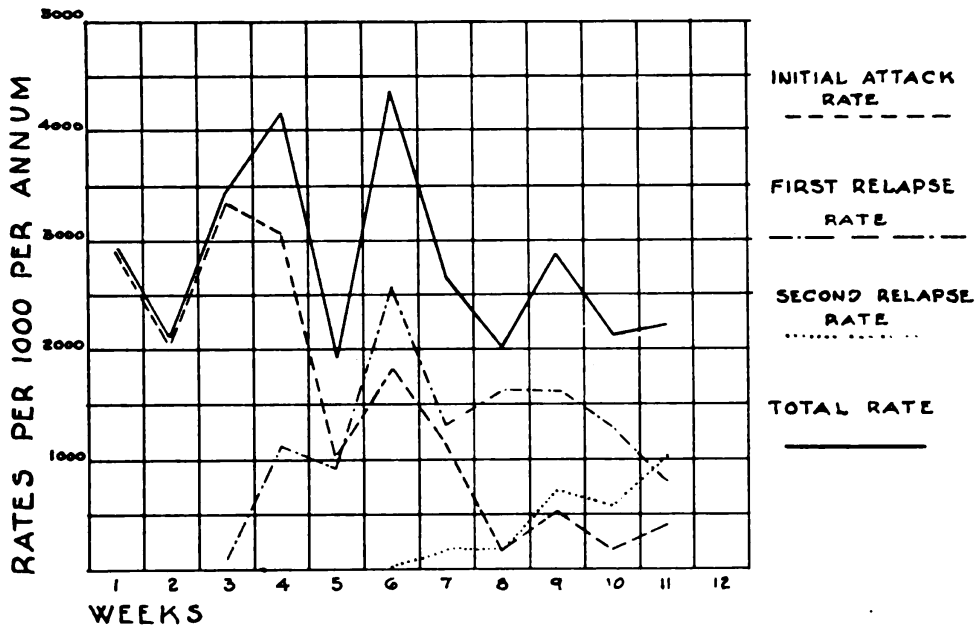
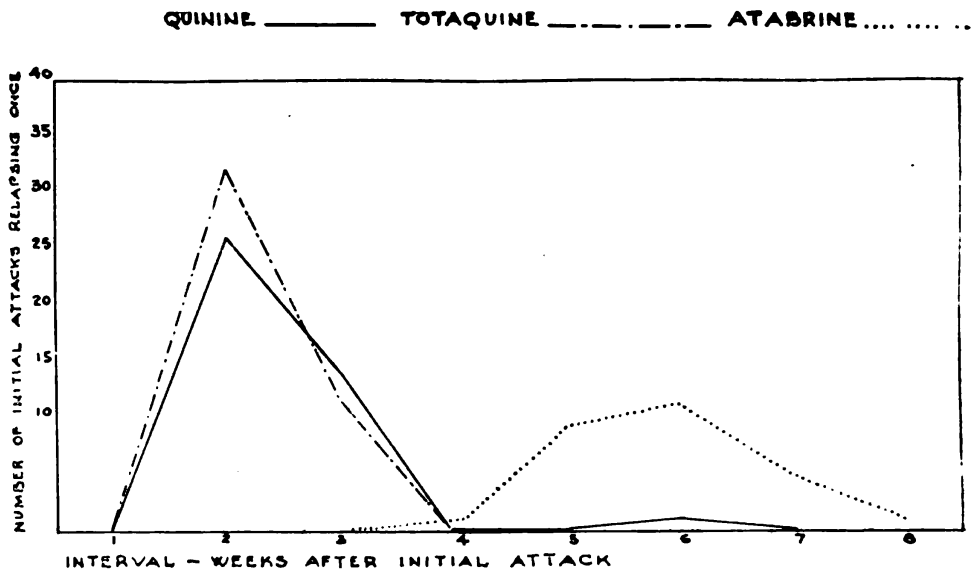


CHART 2





cent) relapsed during this time. The interval between attacks was shortest in cases treated with totaquine, averaging 13.2 days. In cases treated with quinine the average interval was 15.2 days. Cases treated with atabrine did not relapse on the average until 37.4 days. The number of first relapses per week after the initial attack is listed in table IX and presented graphically in chart 2 according to the drug used for treating the initial attack. The early occurrence and greater number of relapses for cases treated with totaquine and quinine are again shown to contrast sharply with the later occurring and lesser number of relapses of atabrine-treated cases.

TABLE IX  
*Number of first relapses per week  
after initial attacks*

Weeks after initial attack	Totaquine	Quinine	Atabrine
1	0	0	0
2	32	26	0
3	12	14	0
4	0	0	1
5	0	0	9
6	0	1	11
7	0	0	5
8	0	0	1
Total	44	41	27

#### CONCLUSIONS

1. Totaquine in the dosage employed caused disappearance of malarial parasites from the blood stream at a time slightly greater than the time for quinine and atabrine. This appears to be of no practical significance.

2. The action of totaquine in control of fever is identical with that of quinine and slightly more rapid than that of atabrine.

3. The action of totaquine in control of malarial symptoms is practically identical with that of quinine and atabrine.

4. The incidence of toxic symptoms is about the same for totaquine and quinine, but the nausea and vomiting caused by totaquine proved more disagreeable than any toxic symptoms of either quinine or atabrine. The incidence of side effects of atabrine is low as compared with totaquine and quinine.

5. The interval between attacks and subsequent relapses was shortest for cases treated with totaquine and slightly longer for cases treated with quinine. Cases treated with atabrine relapsed at intervals which on the average were three times as great as the intervals following totaquine therapy.

**Army Medical Museum Seminars.**—At the weekly seminar at the Army Medical Museum, Washington, D. C., 18 November, Major H. Semenov, A.A.F., discussed the "Physiology and Pathology of the Ear in Military Medicine and Aviation." Dr. Robert A. Moore, professor of pathology, Washington University School of Medicine, St. Louis, Missouri, discussed "Nodular Hyperplasia of the Prostate" at the seminar held on 25 November 1944.

# Surgical Management of Wounded in Mediterranean Theater at the Time of the Fall of Rome

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Wound management may be divided into three phases—initial, reparative, and reconstructive. The first two are concerns of an overseas theater. The last is the mission of the zone of the interior.

The initial surgery of the forward area is primarily directed toward the preservation of life and limb. The immediate physiologic disturbances incident to blood loss and the wound itself are corrected by both resuscitative and surgical measures. Wound infection is prevented or controlled by surgery and chemotherapy. Resuscitation from shock has two goals—to render the casualty transportable and preserve his life until a hospital can be reached, and to prepare the casualty to withstand life-saving surgical procedures. Shock as observed in the forward area is caused by whole blood loss except in burns, crushing injuries, or rapidly advancing infection. Plasma is used in the divisional area to prepare the wounded for transportation and keep them alive until they can reach a hospital. Whole blood would be preferable, but it is not practicable to use transfusions within the divisional area.

Plasma alone is not adequate to prepare a seriously wounded casualty to withstand surgical procedures that are essential or to carry him through the critical postoperative period. After admission to hospital a limited amount is used to augment the effects of whole blood transfusion. Plasma is a substitute for whole blood only in the sense that it can be packaged and stored in adequate quantity in areas where blood cannot be obtained. Plasma is not a substitute for whole blood in the physiologic sense. For these reasons a blood transfusion unit procures and processes whole blood in the base and distributes it to the Army installations.

Shipments of blood were made by L.S.T. to the Anzio beach-head in February. As the front advanced and forward landing strips were opened, blood has been shipped each day by plane. In about four months, over sixteen thousand pints of whole blood

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\*Surgical consultant to the North African and Mediterranean Theater of Operations.

have been drawn and processed for delivery to the Fifth Army. The blood is drawn by vacuum into bottles that are used only once. Glucose is added to the citrate as a preservative. Each flask of blood is triply checked for type, examined by smear for malaria, and Kahn tested. Although Type "O" blood is commonly referred to as "universal donor" blood, its use in large amounts in patients of other types is hazardous unless the agglutinin titer is low. Every bottle of blood is titered and only those with an agglutinin titer less than 1 to 64 are issued as "universal donor" blood. All banked blood carries an expiration date of seven days. To augment the supply of blood forwarded from the base, evacuation hospitals maintain their own unit blood banks. Responsibility for the supply of type specific blood other than "O" rests on the individual hospital.

The initial wound operation is directed toward the prevention of infection by a complete excision of tissue devitalized by the missile. Procedures such as closure of a sucking wound of the chest or suture of a perforation of a hollow viscus restore physiologic equilibrium as well as arrest the dangers of infection. Recognition of all devitalized tissue is oftentimes impossible, particularly in a massive wound or one complicated by skeletal injury. Disturbances of blood supply and subtle changes that indicate impending death of tissues may not be detectable. In a certain number of these cases mixed anaerobic infection of residual dead tissues is the inevitable sequel. Others will develop invasive infection spreading from the wound to involve normal tissues. To minimize the incidence and hazards of infection, primary closure by suture is strictly avoided. Exact maintenance of the reduction of fractures by precise methods is precluded by the necessity for evacuation to the rear; so temporary or transportation splinting, usually with plaster of paris, is employed.

Chemotherapy is initiated in the field by local and oral administration of sulfonamides. The value of this procedure is questioned by many surgeons of experience. Preoperative penicillin therapy is started on all but the lightly wounded casualties on admission to hospital in the forward area. At operation, topical application of penicillin is carried out only in wounds penetrating the meninges, serous cavities, and joints. Parenteral administration is continued beyond the period of the likelihood of infection or until established infection has been controlled. No patient is held in the forward area solely for the purpose of continuing penicillin therapy.

Just as plasma is not a substitute for whole blood in resuscitation, neither are sulfonamides and penicillin substitutes for the surgical excision of devitalized tissue. Chemotherapeutic agents cannot sterilize dead, devitalized, or avascular tissues nor do they prevent the septic decomposition of contaminated blood clot. In this war there have been two quite different approaches to the application of chemotherapeutic agents to military surgery. The first would use these agents to permit delay in wound

surgery and minimize the completeness of the excision of dead tissue. The second employs chemotherapy to extend the scope of surgery and achieve a perfection in results previously considered impossible. The latter policy has guided the surgery of the Mediterranean theater. To reiterate the axiom that penicillin is not a substitute for surgery is not enough. Every surgeon must learn that chemotherapy opens new and startling possibilities in wound management.

The magnitude of surgical problems that confront the forward surgeons when supported by adequate resuscitation therapy is difficult to visualize by one not having a first-hand acquaintance with their work. Highest standards of precision must be maintained if the potentialities of surgery are to be realized to full advantage. This precision must be attained in the use of the adjuncts to surgery as well as in operative techniques. Initial surgery cannot be carried on as a hasty, slap-dash, and bloody spectacle, with rapid evacuation of the patient to the rear, if satisfactory results are to be achieved. The average operating time for certain types of cases recorded at an evacuation hospital were: one hour forty-nine minutes for penetrating wounds of the head; two hours for wounds of the abdomen; two and one-half hours for wounds of the thorax. Many casualties have multiple wounds that require several major procedures in sequence or simultaneously. Postoperative care is as important as the operation and may demand holding the patient for ten days or longer.

#### TRIAGE

Triage at the divisional clearing station based on the urgency of the wound and the condition of the casualty establishes a "three-point forward system" as described by Jolly in the Spanish Civil War. This provides a small surgical hospital for first priority casualties—in this theater, a single platoon of a field hospital reorganized and equipped for this specific mission. Other casualties of less urgent types are transferred back to the chain of evacuation hospitals. An important modification of the system has placed the field hospital platoon in physical conjunction with the clearing station triage point. This provides for the immediate transfer of wounded from the clearing station to the first priority surgical hospital by the hand litter. No pause is required for resuscitation or interference with splinting or dressings. Expert surgical management that embraces resuscitation, operation, and prolonged postoperative care becomes immediately available. Cases with a continuing source of shock, that cannot be made transportable without an operation, are thus salvaged, and the desperately wounded receive expert care as far forward as it can be provided.

Surgeons assigned the responsibility of caring for the wounded in a first priority surgical hospital must be highly trained and experienced, as their tasks are the most exacting of military surgery. The auxiliary surgical group has been found

ideal as a source for this personnel. The experience of the individual surgeon is augmented at the base during periods of an inactive front. Unity and uniformity in the control of this portion of forward surgical personnel have produced a high level of competence as well as economy in the deployment of specialized surgical skill and talent. If the achievements of surgery in this theater are ever judged noteworthy, they are attributable to the fact that expert rather than inexperienced surgeons are doing the work. All other measures are ancillary items. A well-run first priority surgical hospital exerts a remarkably favorable effect on the morale of combat troops and their officers. The divisional medical service receives a stimulus to maintain its arduous task by first-hand evidence that the lives of the most desperately wounded may be saved by skillful first-aid measures and rapid evacuation. Splinting is improved, the use of plasma in aid stations is increased, and the temptation for clearing or collecting companies to indulge in heroic surgical procedures for which they were never designed or equipped is removed.

Evacuation hospitals handle the great bulk of the wounded in the forward area, as the small group of first priority cases diverted to the field hospital platoon constitutes about one-thirteenth of the total number. These institutions, with trained and experienced professional staffs, have attained a high degree of proficiency in the procedures of initial wound management and remain the backbone of the Army medical service.

#### REPARATIVE SURGERY

A highly significant and far-reaching advance in military surgery has taken place in the base hospitals with the development of what may be called *reparative surgery*. Wounds left unsutured at the initial operation are routinely closed by suture, usually at the time of the first dressing. With the use of penicillin as a safeguard against infection, the management of wounds complicated by fracture or joint involvement has been revolutionized. Surgical procedures in special fields of surgery—thoracic, craniocerebral, abdominal—have also been radically altered by the application of similar principles. The significance of this development and its effect on returning an increased number of wounded soldiers to duty and in preventing deformity, disability, and death in the seriously wounded can hardly be overestimated.

Reparative surgery is not to be confused with the reconstructive surgery of the zone of the interior. Reparative surgery is designed to prevent or cut short wound infection either before it is established or at the period of its inception. Once established, wound infection is destructive of tissue and, at times, of life. In many instances it permanently precludes the restoration of function by the most skillful reconstructive efforts. If the initial wound operation has been a complete one, wounds of the soft parts may be closed by suture on or after the fourth day.



The dressing applied in the evacuation hospital is removed under aseptic precautions in an operating room of a general hospital at the base. Following closure, the part is immobilized preferably by a light plaster, or, if this is impracticable, by bed rest. Decision to close a wound by suture is based solely on an appraisal of the gross appearance at the time of removal of the dressing. Preliminary qualitative or quantitative bacteriologic analysis of the flora of the wound by smear or culture does not provide information pertinent to this decision or allow the prediction of the result. "Clean" wounds that heal by first intention after delayed closure may show a profuse and varied flora, both anaerobic and aerobic. Identification of species and tests for pathogenicity would require weeks of arduous laboratory procedure.

It is estimated that during the Italian campaign alone, at least 25,000 soft part wounds have been closed on the basis of gross appearance only. Healing has resulted in about 95 percent, and no loss of life or limb or serious complications have been reported. Residual dead tissue in a deep recess of the wound is the most common cause of the failure in the 5 percent that may be classed as unsuccessful closures. If the suture is not successful because of infection, appropriate studies and corrective therapy are instituted before resuture is attempted. The presence of residual dead tissue or established invasive infection at the time of the first dressing is evidenced by discharge of pus and redness and edema of the wound margins. When these are present but minimal, the wound is allowed to "clean up" with moist dressings. Surgical excision of devitalized fragments or removal of retained foreign bodies may speed this process. Secondary closure may then be performed after a few days. If established infection is severe or if the patient is toxic or anemic, a course of penicillin therapy and blood transfusions is instituted and followed by radical wound revision with staged closure. The topical use of sulfonamides appears to contribute nothing to the favorable results of reparative wound surgery. Parallel series of closures show as satisfactory or better results without the topical application of sulfonamide at the time of suture, as with it. Penicillin therapy is entirely unnecessary as an adjunct to the usual reparative surgery of soft part wounds. It is used parenterally for cases of established infection and in the reparative surgery of complicated wounds.

The reparative surgery of complicated wounds, including those with extensive muscle damage as well as those with skeletal or joint injury and penetration of the viscera, is a more major undertaking. In this group both the incidence and hazards of infection may be expected to be greater. It is this group of cases that is kept on penicillin therapy during the interval between initial and reparative surgery and so maintained until the likelihood of infection is past. Immediate correction of secondary anemia on arrival at the base is an essential part of the

program, as the days are few during which the anemia from the initial blood loss may be projected into the anemia of chronic infection and indolent wound healing. The procedures of reparative surgery are frequently of great magnitude and the patients must be adequately supported by whole blood transfusions before, during, and subsequent to operation.

Compound fractures are removed from transportation splints, the wound is revisioned for further removal of devitalized tissue; reduction of the fracture is secured and maintained by skeletal traction, internal fixation, or other means as indicated. The original débridement incisions directly compounding the fracture site are closed by suture. Dependent stab wound drainage to the fracture site is usually established for a limited period of time.

Open arthrotomy is carried out for impending or early joint infection. Devitalized cartilage and retained foreign bodies are removed and the joint space closed. In a few cases when serious trauma or early established infection has irreparably ruined the joint architecture, resection of the joint has been performed and satisfactory healing in a position of maximum usefulness achieved.

Radical management of massive organizing hemothorax by thoracotomy, evacuation of the clot, and decortication of the lung has proved its effectiveness in returning soldiers to duty and appears to have diminished the incidence of empyema. The same procedure applied to established posttraumatic empyema with penicillin therapy as an adjunct is followed by immediate healing with a fully expanded lung. It is no longer acceptable to hold that a patient with a penetrating chest wound is making satisfactory progress as long as empyema has not made itself manifest. The focus has been changed from the management of posttraumatic pleural infection to the preservation of lung function. In the history of military surgery this will stand as one of the significant advances of World War II.

Early closure of small intestinal fistulae is a life-saving measure. Repair of exteriorized segments of large bowel returns a certain number of soldiers to limited duty and simplifies the nursing problems of the evacuation of others to the zone of the interior. Loop-sigmoid colostomy as an adjunct to the management of wounds of the perineum and anal regions has permitted early secondary suture followed by closure of the colostomy and return to full duty.

Skin loss in wounds comes from the missile, the over-enthusiastic surgeon, or infection. Skin defects attributable to tangential hits or the tearing action of the missile at the wound of exit are repaired by skin grafts as early as the fourth day following injury. In facial injuries, splinting of the bony parts and primary suture of soft parts with provision for drainage at

the time of initial surgery are followed by meticulous wound management on arrival at the base. It is believed that there is a material reduction in the incidence of disfiguring mutilations. Extensive loss of skin and soft parts attributable to the missile is not commonly observed, and it seems likely that many of the facial mutilations of warfare are attributable to loss of tissue by sepsis and contracture—both preventable.

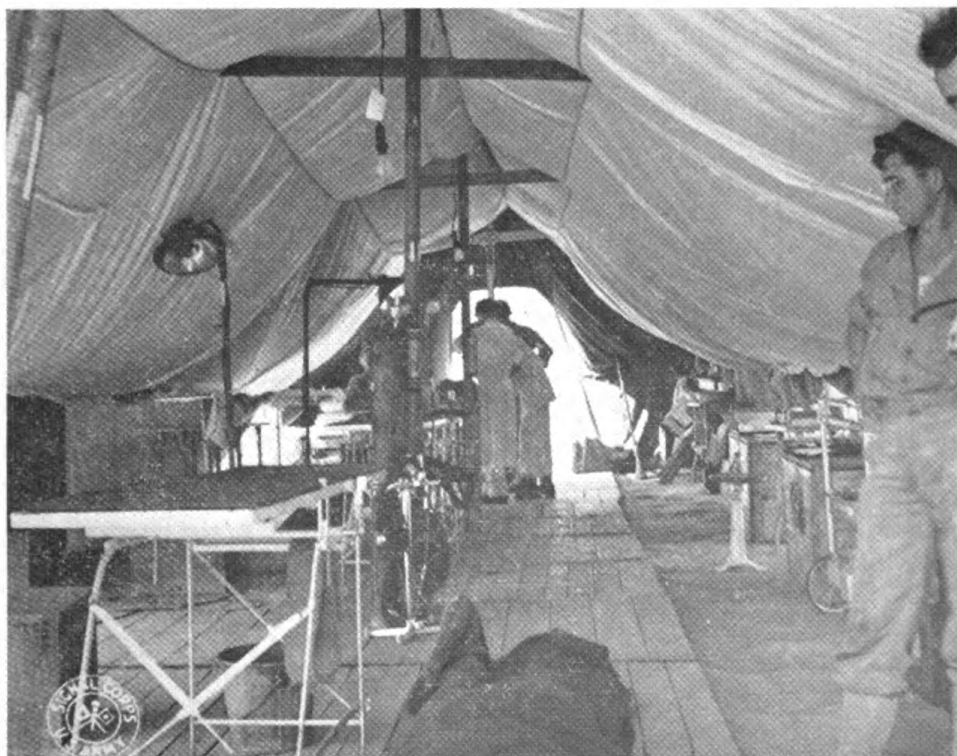
Revision of craniocerebral wounds, when there is evidence of residual devitalized tissue or impending infection, is followed by closure when feasible even if established infection is disclosed. Observations are being made relative to the earlier repair of peripheral nerve injuries. This is a procedure that may better be considered as early reparative surgery rather than late reconstructive surgery. The projected method of management includes revision and appraisal of the nerve injury at the time of secondary wound closure and in suitable cases repair as soon as satisfactory healing is established (two and one-half to three weeks).

To realize fully the potentialities of reparative surgery requires the introduction of a new concept in the organization of military surgery. The time-lag between wounding and initial surgery, referred to as "the golden period," has been greatly reduced by the organization of medical service to this end in the forward area. The time-lag between initial surgery and reparative surgery has now assumed an equal degree of importance. Just as every hour added to the time-lag between injury and initial surgery increases the loss of life and limb, so does every day added to the time-lag between initial and reparative surgery. Four to ten days is the "golden period" to close wounds, reduce and fix fractures, remove retained missiles, and carry out other procedures to prevent or abort infection. To fail to take cognizance of the potentialities of early reparative surgery at the base in future plans and operations will be as unthinkable as a failure to plan for the removal of the wounded from the field of battle.

Air evacuation between army and base, early establishment of general hospitals in close support of an advancing army, sorting of casualties on arrival at base so they may have the benefit of expert and specialized surgical management are matters of administrative import. Education of surgeons to undertake new and unfamiliar procedures, the correction of anemia by whole blood transfusion so that essential surgery may be undertaken at a nearly date, and increased attention to rehabilitation procedures are some of the major problems faced by professional personnel. Particularly important is the concept that the surgical management of a wounded soldier from the field of battle to his ultimate hospital disposition within the theater demands continuity of policy and effort. A wounded man is not like a box

of ammunition or a crate of rations that can be deposited at the boundary of an echelon and responsibility dismissed. Only by coordination of policy and methods between echelons can military surgery attain its full stature.

It is a satisfaction to note the contrast between the present concept of wound management and the doctrines in vogue scarcely a year ago. The closed-plaster management of wounds and fractures was designed to conserve life but exacted a high price in skeletal and soft part deformity. Its use is now limited to certain cases with established infection of bone or with massive defects of soft parts compounding a fracture site. Recommendations that minimized the necessity for a complete initial wound operation or sought to delay it (wound trimming, "salting down with sulfa drugs," etc.) accepted suppuration as inevitable in a considerable proportion of cases and relied on chemotherapy to hold sepsis within bounds. Resuscitation measures that relied on plasma alone to compensate for loss of whole blood prolonged life but tied the hands of the surgeon in the performance of life-saving surgery. These and other earlier concepts were but faltering steps toward what will emerge as the ultimate scope of surgery as developed in the present war.



Surgery of an evacuation hospital in Sicily.

## Supply of Preserved Blood to European Theater of Operations

### A Preliminary Report

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The need for whole blood transfusions in addition to plasma for the treatment of battle casualties has been well established by results obtained during recent campaigns in Africa, Sicily, Italy, and France. To provide for this need, plans were made by the Chief Surgeon's Office of the European Theater to establish and operate a blood bank. The plan for the transfusion service included collecting teams, processing unit, delivery teams, and sufficient equipment for these teams to carry out their individual functions. The vision shown in providing this service and the efficiency of these units have been demonstrated in recent military operations in France.

The ETOUSA blood bank has been completely dependent on military personnel in that theater as the only source of blood. The large demands for whole blood imposed by heavy fighting made it apparent that the donor panel available would be insufficient to meet the daily requirements of each of the armies engaged in combat. It seemed advisable to request The Surgeon General to implement the blood supply in this theater with blood collected in the United States, as the donor panel in the States is many times larger than the military population in the ETO.

The Surgeon General was requested to provide 1,000 pints of blood per day, and plans were made immediately by The Surgeon General's Office to set up bleeding centers and obtain equipment for this program. On 16 August, in a joint conference of representatives from the Chief Surgeon's Office, ETO, and The Surgeon General's Office, methods to be used



in collecting blood in the United States and transporting it to the ETO were discussed. Only methods and equipment which had been tried and proved to be adequate were considered. The proposals made at this conference were agreed on by all concerned, and on 21 August the first shipment of blood was flown to Scotland. The supply of blood from the United States has been continuous since that time.

Three collecting points were established in the American Red Cross blood donor centers in New York, Washington, and Boston. Donors are procured and blood is actually collected by Red Cross personnel. The selection of group "O" donors, blood grouping, cleaning and preparation of equipment, and packing the blood for shipment are carried out by Army and Navy personnel. The transportation of blood by air to the ETO is a function of the ATC.

#### GROUP "O" DONORS

The problems involved in providing from 750 to 1,000 pints of proved group "O" blood daily to the ETO from the United States are numerous. An unprecedented program of this kind raised questions such as the following: the most practical means of selecting "O" donors and then proving the blood group; the type of container to be used in order to assure sterile, pyrogen-free blood; the selection of a suitable preservative to store blood for an adequate dating period; how the blood could be transported and, in the absence of refrigeration, if it could be flown for twenty-four hours without significant changes in quality; the type of giving set to be supplied for administration; and how patients would respond to blood collected in the States, flown unrefrigerated 3,500 miles, and given during the eighteen-day period allowed after it was taken from the donor. To conform to the request made by the ETOUSA, it was necessary to proceed on the basis of information already at hand if we were to make the supply of blood from the States immediately available. The methods we have employed were adopted on the basis of the information obtained through experiments conducted at the Army Medical School and the actual operation of a blood bank at the Walter Reed General Hospital. It is recognized that improved methods and preservatives may become available in the near future.

The existence of actively operating blood donor centers in the United States has greatly simplified the procurement of donors and the collection of blood, but the selection of group "O" donors in large numbers presented a new problem.

It was desirable to screen the donors prior to collection so that only group "O" donors would be bled into the special bottle provided by the Army for overseas shipment. Screening has been done by utilizing proved group "O" serum. This

serum is prepared at the Army Medical School and is put up as a single unit in a small glass shell. The serum is desiccated, stoppered, and supplied with a duplicate shell containing physiologic sodium chloride solution. When the donor arrives at the table for hemoglobin determination, a drop of blood is collected in the shell containing the saline solution, thus providing a cell suspension. Two drops of the suspension are added to the shell containing the dried serum and the tube is shaken. It is then attached to the donor's card and the tube is read just prior to bleeding. As the group "O" serum contains both anti-A and anti-B agglutinins, agglutination in the tube means the donor cells contain "A" or "B" or both agglutinogens, whereas the absence of agglutination indicates the absence of agglutinogens and tentatively designates the donor as belonging to group "O." Although the method outlined is effective in about 98 percent of donors, a secondary check is necessary to prove the group. This is done by typing each donor with red cells of known "A" and "B" groups. It is felt that this method of screening and typing reduces the possibility of error to a minimum.

#### OPERATION

For the proper operation of a blood bank, it is essential that blood be supplied sterile and pyrogen-free. Although there are many types of containers which can be used for this purpose, a commercially available vacuum bleeding bottle was chosen for several reasons to supply blood to the ETOUSA. This type of bottle has been used satisfactorily by the Army Medical School for the past four years. During this time, liquid plasma has been prepared and supplied in the bottle to all hospitals in the zone of the interior, and blood banks in several general hospitals have been operated successfully using this type of container. It can be used safely and economically. This bottle is relatively inexpensive and, when used in place of locally prepared containers, conserves personnel which otherwise would be required in each installation to clean bottles and prepare solutions. In addition, when this container is employed, the user is assured of having sterile, pyrogen-free bottles and solutions. Even though the evacuated bottles can be used only once, they are still acceptable because it would not be economical to return them by cargo ship or plane to the zone of the interior for re-use.

The selection of a suitable preservative solution for blood was the most difficult problem. There is little unanimity of opinion on this subject, as indicated by the numerous solutions which have been proposed. Starting with the premise that fresh whole blood is superior to preserved blood, but realizing that the life of the former is inadequate to fulfill the requirements imposed by shipping blood from the zone of the interior to the ETOUSA, it was imperative that we decide on a preservative solution that would conform to our needs. Clinical

and laboratory experience at the Army Medical School, based on the use of several well-known preservative solutions, indicated that Alsever's solution was as acceptable as any tested. This solution combines proper concentration of electrolytes and dextrose with sufficient dilution and correct pH to assure minimum fibrin formation and satisfactory preservation for twenty-one days. The clinical experience obtained in this study was based on 2,000 transfusions given at the Walter Reed General Hospital in twelve months.

#### REFRIGERATION

Another point which arose immediately and which was directly concerned with the preservatives selected was the feasibility of flying blood for a period of eighteen to twenty-four hours without refrigeration. Even though Alsever's solution can be used perfectly well when blood is refrigerated, its acceptance as an adequate preservative was contingent on its ability to preserve blood properly during the period when blood was unrefrigerated. To answer this problem, blood collected in Alsever's solution was flown unrefrigerated to the United Kingdom and back to Washington, also to Los Angeles and back to Washington, each shipment averaging five days without refrigeration. Simultaneously, bottles of blood were held in the laboratory for varying lengths of time unrefrigerated. Some of the test bottles were used clinically and others were used in the laboratory to determine, by the Bing and Baker technique, the amount of free hemoglobin released. The results were as follows: Blood collected in Alsever's solution and unrefrigerated for five days can be injected into patients seven or eight days after the blood is collected, without producing immediate or delayed reactions. Red blood cells in whole blood kept unrefrigerated release hemoglobin faster than cells that are refrigerated. Preserved blood (in Alsever's solution) that has an expected life of thirty days, when unrefrigerated for five days is reduced to an expected life not to exceed eight days. It was concluded from these studies that blood collected in Alsever's solution, after adequate pre-chilling (twenty-four hours), could be flown unrefrigerated for twenty-four hours from the United States to the United Kingdom and would be safe to use for twenty-one days after collection, that is, when the blood is refrigerated continuously following its arrival in the United Kingdom. In order to lean toward the conservative side, this time interval was decreased to eighteen days so that now all blood shipped from the zone of the interior has a dating period of eighteen days. Experience has shown that the bottles of blood, upon arrival in the United Kingdom, after being en route for sixteen to eighteen hours, are still relatively chilled. This is

done by packing the bottles in heavy pasteboard containers, keeping the blood well chilled up to the time of departure, and then flying the blood in relatively cool cabins. Six-liter bottles packed together serve as a good eutectic plate which prevents rapid heat exchange. Blood shipped in the manner outlined has proved satisfactory. Samples from these bottles have been tested and proved to be acceptable. The amount of free hemoglobin released and the fragility of the red blood cells were comparable to readings made on blood collected in the ETOUSA blood bank.

Realizing the difficulties involved in preparing giving sets in individual hospitals and the large personnel required to carry out this function, it was thought advisable to supply a sterile pyrogen-free expendable set with each bottle of blood from the United States. Although it is difficult to supply an inexpensive set complete with all the refinements, and one which will be acceptable to everyone, an effort has been made to provide a set with an adequate filtering mechanism which can be used with ease by the majority of doctors, nurses, and technicians called upon to use it. The set (figure 1) consists of the following parts: filter housing and connector (glass); filter, Monel metal, 100 mesh, single layer; rubber stopper, perforated; glass connecting tube; rubber tubing 36" (1/8" x 1/32"); intravenous needle, hose rub. 18 gage; and airway tube, metal, 18 gage.

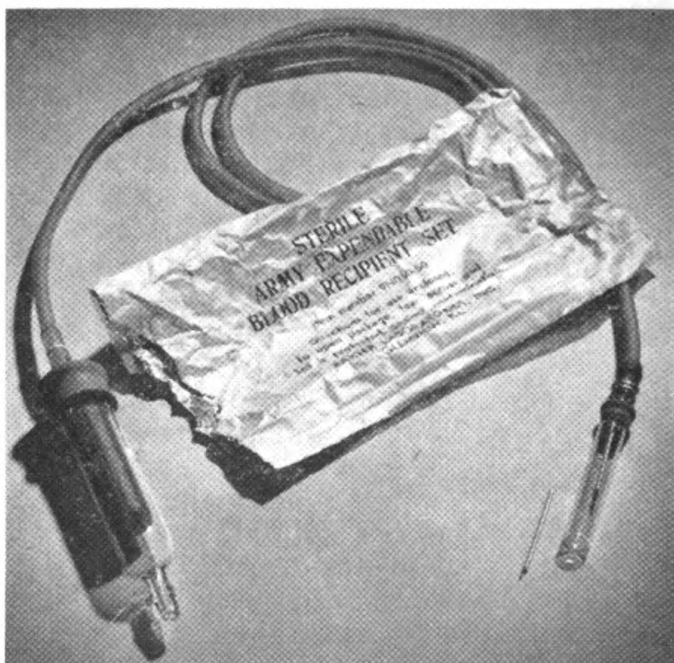


FIGURE 1

The glass filter housing has a connector at one end, which is used to engage the blood bottle at the "free hole"; the other end is closed by a perforated stopper.

There is a glass tube through the hole of the stopper which is attached to the 36-inch rubber hose. At the other end of the rubber hose is an 18-gage hose-hub intravenous needle. The Monel metal filter in the glass housing is inverted and held in place by the plug of the rubber stopper at the lower end of the



housing. The filter is purposely inverted so that blood runs from without into the filter, thereby increasing the filtering surface about 33 percent. There is also provided a 2-inch metal airway tube which, when inserted, provides an outlet for the glass airway tube. When using this set, the glass housing should be *completely* filled so as to allow no break in continuity of the blood between the housing and the blood in the bottle. In this way, an adequate head of pressure, extending from the top level of the blood in the bottle to the lowest level of the tubing, is assured (figure 3).

This procedure is essential to provide a steady flow of blood into the vein. This set does not provide a drip indicator or a Luer-tip glass connector for the needle. These are refinements which are not absolutely essential for the injection of whole blood. In the absence of a drip indicator, the following suggestions are pertinent: The rate of flow is automatically controlled by the gage of the needle when the head of pressure is constant. A drop of fluid held in contact with the metal airway will demonstrate whether or not the blood is running into the vein, for as blood runs out of the bottle suction is created at the airway outlet so that a small amount of fluid will be sucked up into the tube. Occasionally,

in casualties with collapsed veins which are hard to enter, it is helpful to be able to disconnect the needle and attach it to a syringe to aid in locating the vein. The expendable set, as provided, does not lend itself well to this technique. However, when indicated, the needle on the set can be disconnected and replaced by a sterile Luer-tip connecting tube and needle taken from the



FIGURE 2



plasma set and the above procedure carried out with ease. Plans are now being made to supply the expendable set with a Luer-tip glass connecting tube. The sterile expendable set described is supplied in a sealed aluminum foil or aluminum tube container to maintain sterility (figure 2).

An expendable donor set is also provided for collecting blood into the evacuated bottle (figure 4). This set consists of the following parts: 1 needle, 16 gage; 1 needle, 17 gage; 1 clamp, Hoffman type; and rubber tubing, 3/16" x 3/32", 18 inches in length.

In order to bleed a donor, the clamp is placed on the rubber tube near the 16-gage needle and is tightened sufficiently to close the lumen of the tube. The 16-gage needle is inserted through the thick portion of the rubber stopper into the bottle. The 17-gage needle is inserted into the vein of the donor, following which the clamp is loosened. The rate of flow of the blood is then controlled by the clamp. Although this donor set is considered expendable, it can be used about six times when facilities are available for proper cleaning and preparation of the set.

The donor set is supplied in a sterile and pyrogen-free form in a sealed aluminum tube container.

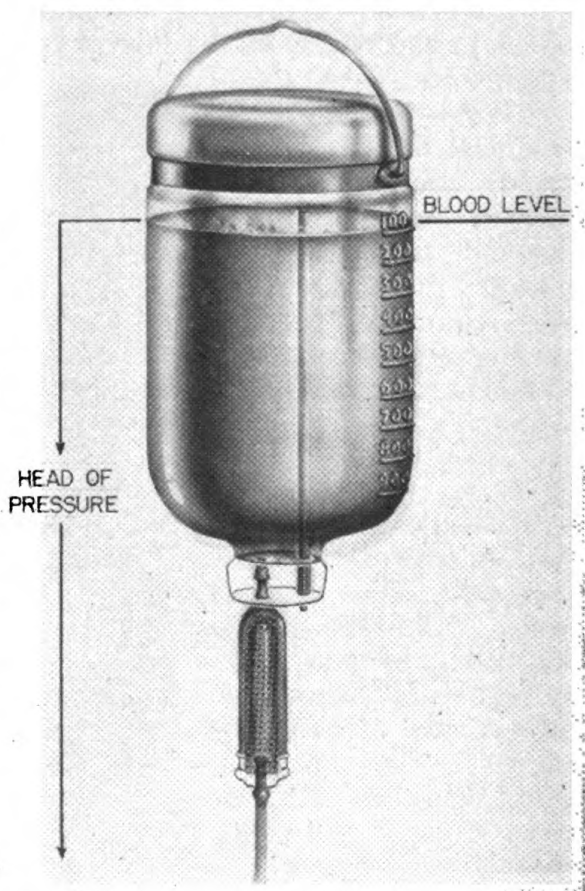


FIGURE 3. An adequate head of pressure is maintained by completely filling the glass filter housing with blood. If an air pocket is left in the housing, the blood will not run into the vein freely.

#### SUMMARY

It is early yet to appraise the relative merits of this program. After surveying most of the hospitals in the ETOUSA that are using blood provided from the United States, it appears that a supply of blood from the United States, in the manner described, is feasible. About 45,000 bottles of blood have been

delivered to the ETOUSA since 21 August, of which close to 40,000 have been used. The results obtained have been comparable to those following the use of blood prepared by the ETOUSA blood bank.

The use of Alsever's solution for the preservation of blood may be open to question primarily because of the large volume of fluid required to give a pint of blood. This objection may be valid but it must be carefully weighed against the need for prolonged preservation which is permitted by collecting blood in Alsever's solution. At present, the National Research Council and the Army and Navy are investigating the relative merits of other preservative solutions. When a more acceptable solution providing a smaller dilution factor is found, it will be recommended for use, and the transfusion equipment used for supplying blood to the ETOUSA will be modified accordingly.

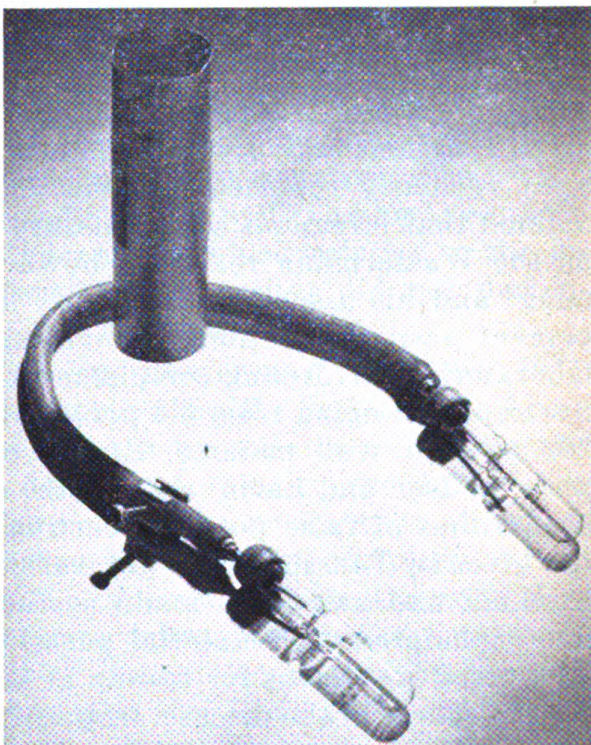


FIGURE 4

The program to supply blood to the ETOUSA from the zone of the interior, employing the methods and equipment described, should be continued.

**Viruses** usually produce immune bodies. These may be detected in convalescent patients by neutralizing experiments in which a known quantity of virus is neutralized by immune serum or indirectly detected by a complement-fixation test. It is now the accepted view of virologists that immunity processes in the host persist only as long as active virus remains in the body cells. The viruses are apparently permanently imprisoned within various cells in many virus diseases and keep up a high titer of immune bodies throughout the entire life of the host. In other conditions, however, such as the common cold or influenza, the parasitized cells, being epithelial, are probably sloughed off and the individual promptly loses his immunity. (Pearson, Emmet F., Lieut. Colonel, M.C., A. U. S., "Present Concepts of Virus Diseases," Mil. Surgeon, November 1944).

# Effect of Malaria on Serologic Tests for Syphilis

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It is generally admitted that positive Kahn and Wassermann reactions may occur in malaria, but their incidence has been variously reported. Kolmer<sup>1</sup> at one time was of the opinion that infections of this nature had no influence *per se* on the Wassermann reaction; however, in a study by Cumming<sup>2</sup> and his associates, Kolmer's laboratory reported 19.4 percent positive reactions in malarial patients. Three other laboratories performing complement fixation tests found positive results ranging from 8.6 percent to 20.6 percent. Among 266 patients with malaria, Hazen<sup>3</sup> obtained 8 percent positives; Wilson and Levin<sup>4</sup> and Curth<sup>5</sup> also reported significant proportions of false positive reactions. Figures on the Kahn test given by Taussig and Orgel<sup>6</sup> varied from 9.9 to 80 percent. Kitchen<sup>7</sup> and associates made a study of 25 persons whom they inoculated with malarial parasites and from whom they took blood specimens for testing at semiweekly intervals during the course of the disease. A positive reaction was obtained in each case where clinical manifestations of malaria were observed. Parasites were obtained in the blood stream of most patients between eleven and thirteen days after infection, and 72 percent of the resulting serological positives were observed in the third and fourth weeks after the inoculation. Positive reactions in some instances were discovered before the period of clinical activity and persisted in 48 percent of the cases for

Accepted for publication 20 October 1943.

The Venereal Disease Research Laboratory, U. S. Public Health Service, Staten Island, New York, supplied the antigens used in this study.

1. Kolmer, J. A.: Specificity, Sensitiveness, and Practical Value of Kolmer-Wassermann Reaction, *Am. J. Syph.*, 13:248-267, April 1929.

2. Cumming, H. S., Hazen, H. H., Sanford, A. H., Senear, F. E., Simpson, W. M., and Vonderlehr, R. A.: The Evaluation of Serodiagnostic Tests for Syphilis in the United States, *J. A. M. A.*, 104:2083, 8 June 1935.

3. Hazen, H. H., Senear, F. E., Parran, T., Sanford, A. H., Simpson, W. M., and Vonderlehr, R. A.: Serologic Evidence of Syphilis in Malarial Patients, *Arch. Derm. Syph., Chic.*, 37:421-440, March 1938.

4. Wilson, R., Jr., and Levin, S. L.: Observations on Effect of Malaria on Wassermann Reaction, *Am. J. M. Sc.*, 191:696-702, May 1936.

5. Curth, W.: Syphilis in the Highlands of Guatemala, *Am. J. Syph.*, 17:164-175, April 1933.

6. Taussig, A. E., and Orgel, M. N.: Kahn Test in Malaria, *J. Lab. Clin. M.*, 22:614-618, March 1937.

7. Kitchen, S. F., Webb, E. L., and Kupper, W. H.: The Influence of Malarial Infections on the Wassermann and Kahn Reactions, *J. A. M. A.*, 112:1443-1449, 15 April 1939.



longer than four weeks. *Plasmodium vivax* infections seemed to induce a greater proportion of positive serologic results than did infections with *Plasmodium falciparum*.

Burney<sup>8</sup> and associates inoculated 11 nonsyphilitic patients with malaria and performed several kinds of serologic tests on their blood serums. False positive reactions occurred in a high percentage in all tests except the Hinton in which three of ten were doubtful and seven negative. The writer stated that the duration of clinical activity, highest temperature reached, time of withdrawal of blood relative to the individual paroxysm, or density of parasites did not demonstrably influence the serologic reaction.

At the Washington Serology Conference<sup>9</sup> in October 1941, sponsored by the U. S. Public Health Service, specimens from 12 patients diagnosed as having malaria were tested by the 19 originators of 30 different serologic procedures. The results showed varying degrees of false positivity in all except the Hinton flocculation test and the Mazzini complement fixation test (unpublished). The types of malaria and conditions under which the bloods were taken for analysis were not stated. Other workers<sup>10-16</sup> incl. did not encounter false positives with the tests that they employed.

#### METHOD

The present work was undertaken at a large Army hospital where many cases of malaria were available for study, with the purposes of determining which of the serologic tests gave the least proportion of falsely positive reactions and whether it was possible to distinguish malaria from syphilis on the basis of definite patterns of positivity among the different tests.

8. Burney, L. E., Mays, J. R. S., and Iskrant, A. P.: Results of Serologic Tests for Syphilis in Non-syphilitic Persons Inoculated with Malaria, *Am. J. Pub. Health*, 32:39-47, Jan. 1942.

9. Parran, T., Hazen, H. H., Mahoney, J. F., Sanford, A. H., Senear, F. E., Simpson, W. M., and Vonderlehr, R. A.: Preliminary Report on the Washington Serology Conference, *Vener. Dis. Inform.*, 23:161-194, May 1942.

10. Lloyd, R. B., and Mitra, G. C.: Wassermann Reaction in Malaria, *Ind. J. M. Res.*, 14:135-144, July 1926.

11. Lloyd, R. B.: Interpretation of Wassermann Results in India, *Ind. M. Gaz.*, 67:1-5, Jan. 1932.

12. Needles, R. J.: Effect of Endemic Malaria on Incidence of Neurosyphilis, *Arch. Neur. Psychiat.*, Chic., 34:618-624, Sept. 1935.

13. Greer, A. E.: Routine Blood Wassermann Reaction in Private Practice, *Texas J. M.*, 19:485-490, Jan. 1924.

14. Saunders, G. M., and Turner, T. B.: Wassermann Reaction in Malaria, *South. M. J.*, 28:542-546, June 1935.

15. Menk, W.: A Comparison of the Complement-Fixation Test (Wassermann Reaction) and Meinelcke's Turbidity Reaction (M.T.R.), in Serodiagnosis in the Tropics, United Fruit Company, Medical Department, Annual Report, 1926.

16. Heinemann, H.: Untersuchungen ueber den diagnostischen Wert der Methoden von Wassermann, Sachs-Georgi und Meinelcke (D.M.) in Malaria-landern (Das Verhalten des Blutserums bei Malaria), *Munch. med. Wschr.*, 68:1551, 2 Dec. 1921.

The standard flocculation tests described by Kahn,<sup>17 18</sup> Mazzini,<sup>19 20</sup> Eagle,<sup>17</sup> Hinton,<sup>17</sup> and Kline,<sup>17</sup> and the standard complement fixation test of Kolmer<sup>17</sup> were employed in this study. The antigens in all cases were approved by the originators of the tests, and were provided by the Venereal Disease Research Laboratory of the United States Public Health Service. Fresh guinea-pig complement for the Kolmer test in no instance reacted nonspecifically (Harris<sup>22</sup>) with the antigen employed in the manner described by Giordano and Carlson.<sup>23</sup> The Kline<sup>21</sup> antigen was a water-purified product. The latest published techniques were strictly followed and deviations were not permitted.

Patients with blood smears positive for plasmodia were subjected to venipuncture at certain intervals, i.e., between one and four days, seven and ten days, and twelve and thirty days. The cases were classified into four groups depending on the species of plasmodia found in the blood smear. When both *P. falciparum* and *P. vivax* were present, the case was classed as a double infection. In some instances where the parasite density was low a specific diagnosis could not be made and the group was entitled "not classified."

More than 8,000 serologic tests were performed on individuals whose histories were negative for syphilitic infection. Both doubtful and strongly positive serologic reactions occurring at any time during the course of the malaria were recorded as "positives." In each instance "doubtful" was recorded in the exact sense of the technique as defined by the originator. The species and stage of the life cycle of the malaria parasite, the temperature of the patient, the variety of chemotherapy, and the lapse of time between the positive smear and the reversion of serology to negative were all con-

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17. Eagle, Harry, Hinton, W. A., Davies, J. A. V., Kahn, R. L., Kline, B. S., and Kolmer, J. A.: *Technics of the Eagle, Hinton, Kahn, Kline and Kolmer Tests for the Serodiagnosis of Syphilis*, Sup. No. 11, Vener. Dis. Inform., June 1940.

18. Revision of Interpretations: Communication to V.D. Research Laboratory, Staten Island, N. Y., by Dr. R. L. Kahn, received 16 Dec. 1940.

19. Mazzini, L. Y.: *Mazzini Microscopic Flocculation Test for Serodiagnosis of Syphilis*, Vener. Dis. Inform., 23:123-130, April 1942.

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21. Kline, B. S.: *New Standard Slide Antigen (Water Purified)*, Am. J. Clin. Path., 12:48-61, Jan. 1942.

22. Harris, A.: *Concerning Choice of Complement-Antigen Combination for Use in Kolmer Complement-Fixation Test; Pretesting Method for Complement Selection*, J. Lab. Clin. M., 27:97-102, Oct. 1941.

23. Giordano, A. S., and Carlson, B. G.: *Occurrence of Non-Specific Substance in Guinea Pig Serum Fixed by Antigen in Wassermann Test*, Am. J. Clin. Path., 9:130-135, March 1939.

sidered in planning the procedures and accumulating data. The findings were compared with those on nonmalarial syphilitic sera by the same tests employed in this study.

## OBSERVATIONS

The numbers and proportions of cases in each group and the percentages of positive reactions obtained with each of the serologic tests are presented in table I.

TABLE I  
*False positivity percent*

Species of parasites	Percent of total cases	Percentage of positives					
		Kahn	Kolmer	Mazzini	Eagle	Hinton	Kline
Falciparum	20	48	23	52	15	9	37
Vivax	70	48	21	51	9	3	33
Falciparum and vivax	2	70	52	87	29	17	17
Not classified	8	37	17	47	47	10	41

The Hinton test in the *P. vivax* cases gave the smallest proportion of false reaction. In the *P. falciparum* cases about three times as many false reactions were given by the Hinton test, but even then this test is outstanding in its selectivity. Cases of mixed infections (*P. falciparum* and *P. vivax*) gave the highest incidence of positives in almost all tests.

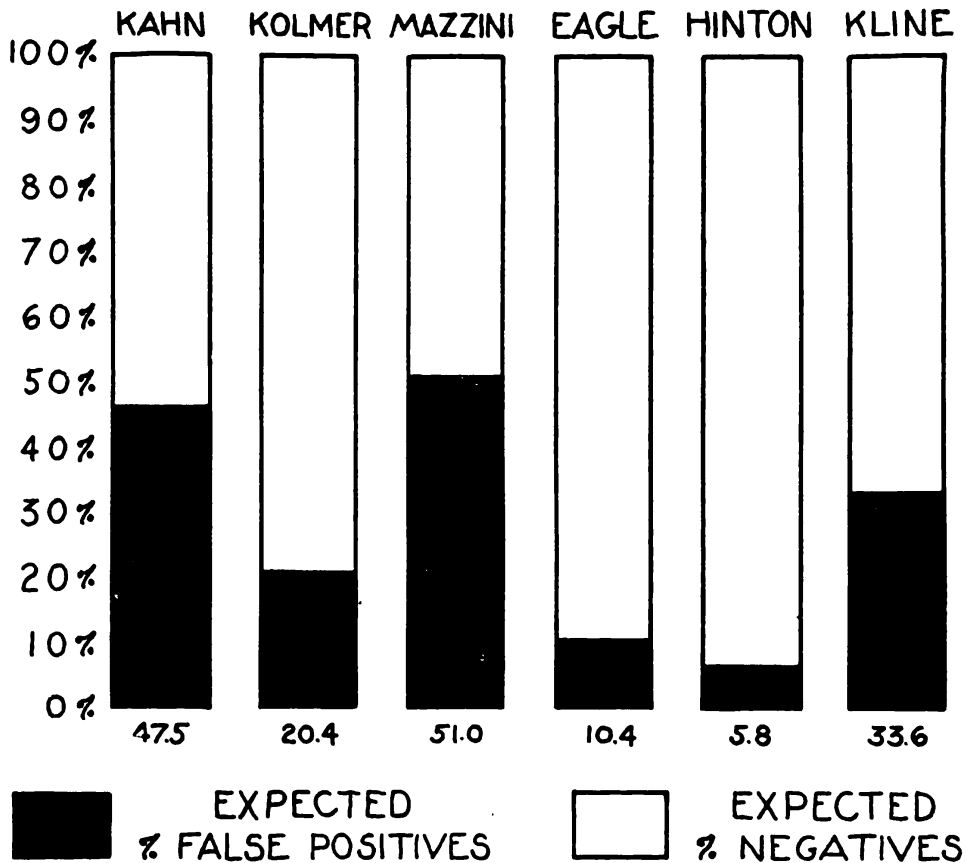
The greatest expected incidence of false positive reactions per 100 malaria cases taken at random in any particular locality can be calculated from the data in table I by weighing the results according to the proportion of the various types of infection in the malarial population. Thus for any particular test, if E represents the expected percentage of false positives attributable to a certain species of parasite, I the percentage of the malarial population infected by that parasite, and P the percentage of false positives with that species (table I), then  $E = \frac{I P}{100}$ . By determining E for each of the four sub-

divisions in table I and adding the results with each type of serologic test, it was possible to construct table II, which represents the expected incidence of falsely positive reactions in the general malarial population in the particular locality



surveyed in the present report. It is obvious that the Hinton test yielded the least percentage of falsely positive reactions (5.8 percent). The standard Kahn test as employed in Army laboratories gave positive reactions in 47.5 percent of the malaria cases.

TABLE II



Correlations were made with certain clinical observations. The strongest false positive reactions were obtained between seven and ten days after the chill and persisted for from four to six weeks. There is no evidence that the serologic response will be quicker or greater in subsequent attacks than during the first. The sera tended to remain positive longer in the case of infections with *P. falciparum*. When the sera were positive in the absence of clinical and historical evidence of syphilis and no plasmodia were found in the blood, questioning and inspection of the records disclosed that positive smears had been in evidence within a period of four to six weeks prior to taking the blood sample for the serologic examination. It was

also recognized that when parasites persisted despite the lack of clinical evidence of malaria, or if there was a recrudescence following an initial diagnosis, the falsely positive reactions either became stronger or remained at a high level. On the contrary, chance observations yielded the information that in some recurrences it was not possible to predict the clinical event of the rigor on the basis of the serology, even when the blood had been tested but one day previously. The serologic reaction was uninfluenced by the predominance of gametocytes, trophozoites, or schizonts in the blood film. Fever was not responsible for the positive reactions since during the chills, when temperatures were abnormally high, serologic positives did not necessarily occur, and contrariwise, falsely positive reactions were often obtained in the malaria cases although the fever had long subsided. Likewise the chemotherapy employed was not significant since positive sera often became negative while the patients were under treatment with atabrine, plasmochin, or quinine.

The data were examined with a view to discovering whether it was possible to distinguish malaria from syphilis on the basis of serology. A characteristic pattern of positivity was found in most malarial sera. Generally, the Kahn test was positive (3+ or 4+) as was the newer Mazzini test. The Kolmer complement fixation test generally gave positive (1+) or doubtful ( $\pm$ ) reactions. Anticomplementary reactions were less than 2 percent, a percentage no greater than is to be expected in routine work. The Kline test varied from doubtful ( $\pm$ , 1+) to weak positive (2+, 3+). In those relatively few instances where the Eagle and Hinton tests were positive, they tended soon to revert to negative. In cases of syphilis, however, the Hinton antigen used in this study proved most sensitive, and this test was positive in some instances even when the other reactions were negative. Concerning the constancy of the pattern the results of the Kolmer tests on the malaria cases show only 2.3 percent 4+ reactions; in syphilis at this age group at least 40 percent 4+ Kolmer-Wassermann reactions would be expected. In cases where malaria was coexistent with syphilis and where the different tests showed a varying response, all reactions became stronger during the course of the malaria. After four weeks the original pattern was restored. Where, within four weeks, there is a steady rise and then rapid fall in the gradient of positivity and malaria is

diagnosed, one can feel assured that syphilis is not a complicating factor, particularly if the Hinton test is negative.

#### COMMENT

Workers in different laboratories have reported divergent results on the same malarial bloods even when they were supposedly using the same test. There may be several reasons for this. Too often workers are inclined to deviate from a published technique and to make slight changes of their own. These may be enough to upset the stability of the substances in reaction and consequently to create a different level of sensitivity and specificity. In many instances the antigens themselves differ and thus great variation results among laboratories; also it is definitely established that the time at which a sample of blood is taken relative to the time that the blood film becomes positive may determine whether or not the serologic response will be positive. These factors may account for the discrepancies on record.

#### CONCLUSIONS

1. The Hinton flocculation test for syphilis yields the smallest proportion of falsely positive reactions in malaria of any of the widely accepted serologic techniques.

2. The pattern of positivity in malaria, i.e., positive Kahn and Mazzini tests, doubtful Kolmer and Kline tests, and negative Eagle and Hinton tests, can usually be differentiated from that of syphilis. Persistence of positive serology by any test beyond six weeks, in the absence of continued evidence of malarial infection, should arouse the suspicion of syphilis.



Wounded American soldiers carried to a beach in southern France to be put aboard LST's. 15 August 1944. Signal Corps photograph.

# Convulsions During Inhalation Anesthesia

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Violent involuntary muscular contractions during inhalation anesthesia have occupied a place of increasing importance among anesthetic complications since the syndrome was first reported by Pinson.<sup>1</sup> A total mortality rate of 18.9 percent was reported in 1937 in a complete review of the literature of 144 cases. Despite the gravity of the condition and the extensive investigations into its nature, the etiology remains obscure. Lundy<sup>2</sup> found in the literature thirty-three different causes or factors believed to be responsible. The treatment of anesthetic convulsions has been almost as varied as the concepts of etiology. Lundy has had success with the use of ultra short acting barbiturates intravenously. Tye<sup>3</sup> and Cook<sup>4</sup> concur in this treatment. Other writers<sup>5</sup> have administered calcium salts intravenously with conflicting opinions as to efficacy. Chloroform<sup>6,7</sup> has been supported and condemned. Carbon dioxide and oxygen inhalations<sup>7</sup> have been used to advantage.

Most authors agree about the clinical picture. The patient, usually a child or young adult, frequently suffers from an acute infection with slight or moderate elevation of temperature. Usually the syndrome begins with muscle twitchings in the face. The twitching spreads to the rest of the body and assumes clonic and tonic phases which frequently result in cyanosis. The pupils are widely dilated and not responsive to light. When death occurs, it is asphyxial in nature with respiratory failure preceding circulatory collapse. When recovery

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Accepted for publication on 5 November 1943.

1. Pinson, K. B.: Convulsions Occurring During Surgical Anesthesia, *Brit. M. J.*, 1:957, 28 May 1927.

2. Lundy, John S.: Convulsions Associated with General Anesthesia, *Surgery*, 1:666, May 1937.

3. Tye, James Pearce: Convulsions of Anesthesia, *South. M. J.*, 35:339-343, April 1942.

4. Cook, William B.: Convulsions Associated with Nitrous Oxide-Ether Anesthesia, *Northwest M.*, 39:182-183, May 1940.

5. Wyatt, O. S.: Convulsions in Children While Under General Anesthesia, *Minnesota M.*, 23:101-105, February 1940.

6. Bowman, Foster H.: Convulsions Under Deep Anesthesia, *Am. J. Surg.*, 23:295-296, February 1934.

7. Payne, R. Vaughan: Ether Convulsions, *Guy's Hosp. Rep., Lond.*, 86: 461-475, October 1931.

results, transient or permanent injury to the central nervous system is not infrequent.

Many clinical pictures differing from that described may occur. Brown<sup>8</sup> reported a case that became typical in its convulsive manifestations, but the onset was in the right foot and leg and not the face. Cases have been reported in afebrile adults<sup>2</sup> and also instances in which the pattern of convulsions did not follow the typical course.

It is important to distinguish between true convulsions and "ether clonus." Lorhan<sup>9</sup> and Payne<sup>7</sup> describe ether clonus as a phenomenon of the induction phase of anesthesia before full surgical anesthesia is attained, consisting of clonic spasms of the arms and legs and lasting for a short time. True ether convulsions occur only during surgical anesthesia or at the end of the operation. The former is benign and is readily remedied by increasing oxygen tension, deepening the anesthesia or changing the position of the patient.

Following is a report of six cases occurring in four white patients, all with complete recovery.

#### REPORT OF CASES

**CASE 1.** A soldier 23 years of age was admitted with the diagnosis of subacute appendicitis. His past history and physical examination were unimportant except for localized tenderness in the right lower quadrant. Temperature was 98.4 rectally and the leukocyte count was 7,500. He was given morphine sulfate 0.01 gm. and scopolamine 0.0004 gm. 1½ hours before induction. The anesthetic was ether with vinethene induction by the open drop method. The operating room was extremely warm. There was moderate excitement during induction. Fifteen minutes after induction, in the second plane of surgical anesthesia and just after the incision was made, clonic convulsive movements of the lower extremities began and spread over the entire body. Surgery was stopped for the period of convulsions which lasted ten minutes. No cyanosis or change in circulation developed. Anesthesia was discontinued and the convulsions gradually disappeared. The resumption of anesthesia was uneventful as was the postoperative recovery.

**CASE 2.** A soldier 22 years of age was admitted for the repair of a right inguinal hernia. The remainder of the history and physical examination was irrelevant. Temperature was normal. Premedication consisted of morphine sulfate 0.016 gm. and scopolamine 0.0006 gm. fifty minutes prior to the induction of open drop ether. Ethyl chloride was employed for induction. The operating room was very hot. Twenty minutes after induction, in the first plane of surgical anesthesia, twitching began in the facial muscles and quickly spread over the remainder of the

8. Brown, D. Masters: A Case of Convulsions After Ether Anesthesia, Brit. M. J., 1:579, 31 March 1934.

9. Lorhan, Paul H.: Convulsions During General Anesthesia, Arch. Surg., 44:268-278, February 1942.



body until marked convulsions occurred, necessitating the suspension of surgery. The convulsions lasted for ten minutes; they ceased for five minutes and then reappeared and remained for five minutes. Anesthesia was deepened at the onset of the first convulsion to second plane and maintained at this level for the remainder of the operation. Slight cyanosis was present during the first convulsion, but none during the second. The postoperative period was complicated only by a cough and temperature of 102.6° F. on the first day. Recovery was complete.

CASE 3. A white soldier 26 years of age was subjected to exploratory laparotomy because of mild signs of intestinal obstruction due to postoperative adhesions. The preoperative condition was good and no fever was present. Morphine sulfate 0.016 gm. and scopolamine 0.0006 gm. were given 1¼ hours prior to the induction of open drop ether. The operating room was hot. Twenty-five minutes after induction, with anesthesia at the second plane level, clonic spasms of all extremities began simultaneously. The convulsion became generalized and was stopped promptly by the administration of chloroform. Respiration and circulation remained intact. Surgery was completed satisfactorily with no recurrence of convulsions. The postoperative period was uneventful.

CASE 4. A soldier 38 years of age was admitted for treatment of an avulsed wound of the right hand. He was anesthetized three times with the nitrous oxide-oxygen-ether sequence, employing the circle absorption technique, and developed convulsions on each occasion. All three operations were performed in hot weather on an afebrile patient. Morphine sulfate 0.016 gm. and scopolamine 0.0006 gm. were given 1½ hours prior to induction in each instance. On all occasions induction was stormy, but not asphyxial. During the first operation, a débridement of the wound, the patient developed severe generalized convulsions which began with facial twitchings and spread to the extremities and then to the rest of the body. No cyanosis or change in circulation was noted. The convulsion occurred one hour after induction while the patient was in the second plane of surgical anesthesia. Chloroform was administered by open drop technique and the convulsion ceased promptly. Surgery was then completed without mishap. Recovery was uneventful.

Eleven days later this patient was brought to surgery for skin grafting. The same type of convulsion occurred forty-five minutes after induction at the same depth of anesthesia as in the first instance. This convulsion was promptly arrested after the administration of 5 cc. of chloroform by open drop. Recovery was complete. Fifteen days after the second operation, the patient was subjected to another skin graft procedure on the affected hand. The same pattern of convulsions again appeared in the first plane of anesthesia after the mask had been removed and the operation was near completion. No treatment was instituted. The convulsion lasted five minutes with no respiratory or circulatory embarrassment. Recovery was uneventful.

#### DISCUSSION

The fact that all of these patients were adults and afebrile, while not a radical departure from the classical syndrome, is nevertheless not typical.

In two of the six convulsions reported, the seizures began in the lower extremities in one instance and in all extremities in the second, rather than with the usual onset in the facial muscles. This differs, also, from the preponderant opinion that convulsive seizures begin with facial twitchings. The relative importance of this observation is not clear, but it is possible that the convulsive seizure may assume a definite pattern for a given individual, as evidenced by the patient who had convulsions during each of three anesthetic procedures, all of the same type, with identical onset.

Another unusual aspect of the convulsive seizures observed in this group is the uniform recoveries without sequelae and the almost benign nature of the episodes. Although the convulsions were severe enough to require cessation of surgical activity, in only one instance was there cyanosis; all of the other seizures apparently did not involve the muscles of respiration. No attempt is made to minimize the gravity of this syndrome, but to point out that the experience with these patients, while alarming at the time, was ideally fortunate in the outcome. The explanation for the complete absence of mortality or unusual morbidity is not apparent. Although chloroform administration was associated with effective cessation of convulsions on three occasions, it is questionable whether expectant treatment might not have been just as effective. No treatment resulted in complete recovery once, whereas withdrawal of the agent and deepening the anesthesia in two other cases were equally efficacious. It is possible that the absence of infection and fever favored the satisfactory resolution of these convulsive seizures.

In regard to therapy with ultra short acting barbiturates, at the time the first two cases were observed, neither pentothal sodium nor evipal soluble was available, and the possible benefit to be obtained from chloroform was not known. The last drug was used on the third case with satisfaction and was therefore employed during the first two convulsions in case 4.

All of these individuals were in superb physical condition at the time of operation, and it is possible that was a factor in their recovery. The military anesthesiologist has an advantage in his "better risk" patient and can expect better weathering of anesthetic storms. This is not to say that slipshod administration of anesthetics is safe. In the armed forces, where ideal equipment may not be available under all circumstances,

a good practice in the treatment of convulsions during ether anesthesia is the administration of chloroform by open drop while an assistant prepares an ultra short acting barbiturate for administration by vein. In this way, in well-conditioned patients, some of the unfortunate results of convulsions during anesthesia may be avoided or minimized.

#### SUMMARY

Among six convulsive episodes during ether anesthesia in four patients, one patient exhibited convulsions on three occasions. Chloroform was satisfactory in therapy in three of the six seizures, no therapy in one, deepening the anesthesia in one, and withdrawal of the agent in one. For the armed forces, the immediate administration of chloroform, while sodium pentothal is being prepared, is advocated. If the former is ineffective, the barbiturate should be injected.

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## Physical Medicine in an Evacuation Hospital

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and

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Medical Corps, Army of the United States

Physiotherapy was used rather extensively in World War I. Elaborate equipment was devised at that time and a considerable number of men and women were trained as technicians. Following that war, both doctors and laymen became interested to such a point that unnecessary, expensive equipment was devised, some of which was designed primarily to impress the patient.

We wish to describe the department of physical medicine established in an evacuation hospital in the jungles of India, including the equipment and its use in the restoration of normal function of the body as a whole. Our experience was largely with Chinese casualties in the China-Burma-India Theater. The background of these patients is such that in most cases modern medical and surgical care is hard for them to understand. They are very conscious of pain and its relief by rest; as a result, it is difficult to encourage them to actively move a limb immobilized for any period of time because of injury. The average American medical officer is occasionally intolerant of such patients. Much of this can be explained by a lack of mutual understanding due to differences in language

and background. In physical therapy, the medical officer needs the cooperation and understanding of the patient. That problem has been difficult but not insurmountable.

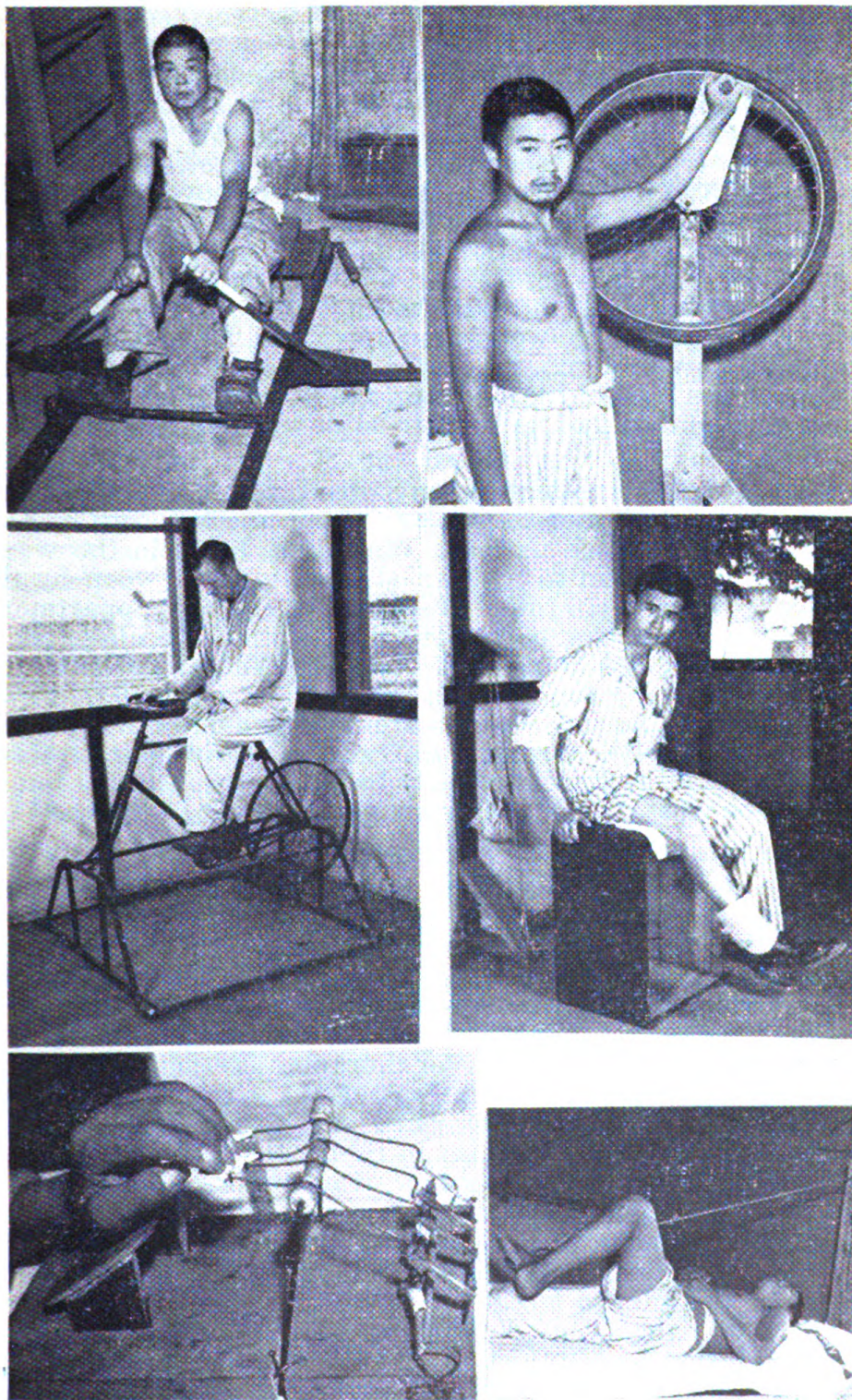
Plaster immobilization has been the common form of treatment for many soft tissue wounds as well as those of the bone. On removal of the cast, often the wound is healed but the use of the limb is greatly limited as a result of immobilization. While it is common knowledge that physiotherapy should be started early, during wartime the medical personnel have more than enough to do, and that fact is often neglected at the expense of the injured soldier. Too frequently a part becomes so fixed because of pain that eventually irreparable damage is done and limited use of an arm or leg results.

Soon after this hospital was organized, it was noted that most of the surgical patients fell into the following groups: (1) trauma of bones and joints—fractures, dislocations, stiff joints; (2) trauma of soft tissues—scars, contusions, lacerations of muscles and tendons, and paralyses, especially those due to peripheral nerve damage. A physical therapy department was necessary to adequately treat such patients and we were able to construct, from makeshift materials, tables, heat lamps, whirlpool and contrast baths, and various types of pulleys for use on particular groups of muscles. We wish to emphasize that the equipment for a department of physical medicine need not be of the type seen in many hospitals at home, but can be made very simply and practically out of material available at any site. We used scrap lumber from packing boxes, discarded parts of trucks, wire, rubber bands, and metal found in the utility building of the hospital. We made a weight-lifting device from stirrups to which ropes and weights were attached. From old gasoline tanks we made whirlpool, foot, and arm baths. An apparatus to provide dry heat was made from a crate with a socket for an electric light in the center. A Chinese officer contributed a bicycle for leg exercises. To heat water, we put a false bottom about a foot from the base of a gasoline drum and, between the false bottom and the base, bamboo chips were set afire to heat the water in the top drum. The hard rubber core of an old softball was used for hand and finger exercises. Some of these improvisations are shown on the opposite page.

#### PERSONNEL

An important factor in the organization of this work was the choosing of enlisted personnel who were to give the prescribed treatments. This problem was particularly important in our hospital where trained physical therapy personnel are not provided. It is necessary to choose men who have a high degree of intelligence and genuine interest in the patient. Interest, patience, enthusiasm, and encouragement play a great part in the functional recovery of the injured soldier.





Improved equipment.

The Chinese patient, let us say, has received a gunshot wound of the forearm with a compound fracture of the radius and ulna. His wound is débrided at a forward echelon and the arm immobilized in plaster with the elbow flexed at 90 degrees. After arrival at a fixed hospital, his cast may be changed in from four to six weeks, the arm again immobilized, and in eight to ten weeks, his cast will be removed. The x-ray shows good anatomical position and callus formation, but there is practically no motion at the elbow or wrist. The medical officer, on removing the cast and finding complete clinical union and healing of the skin wound, is likely now to lose interest. The patient, however, has very poor use of his arm and hand, he fears motion, and confidence in his ability to use his arm becomes less and less. Eventually this soldier becomes a chronic invalid and of no further value to the military organization.

To return the patient to duty with his unit as soon as possible, a careful plan of treatment was prescribed, and a chart was devised for each patient. We found, early in the work, that the patient had to be seen at least twice a week by the medical officer in charge of the physical therapy department. Treatments must not be routine. They must be changed as indicated, progress notes must be kept with careful measurements of returning function, and the patient must be told over and over that these treatments are not the complete cure. He must fully understand that a thirty to forty-five minute daily treatment is not sufficient alone to bring about functional return and that he must continue the exercises on return to the ward.

#### SECTIONS

The several sections in our department were (1) heat and massage, (2) hydrotherapy, and (3) supervised exercise, a section that has proved especially beneficial. It is easy to organize with pulleys, rope, and weights—appliances which will exercise particular groups of muscles. The important factor, however, is actual supervision of these exercises. Our patients return every afternoon for therapeutic supervised muscle training, which we believe has hastened the return of function of many extremities and lessened the period in hospital of many patients. It is important to return the soldier to duty as soon as possible, not only because of his military value but for his own well-being and morale.

Encouragement of the patient and persistence on the part of the technician are of the greatest importance in the early return of function to an immobilized limb. We try to remove the fear of pain in our patients and find it advisable on occasion to use a local injection of novocain. In most cases the patient will move his fixed knee or elbow to a certain point, then stop because of pain in certain areas; in these areas we inject 1 percent novocain around the fixed or spastic muscles and tendons. One must not be too radical, because often an



effusion results when this deformity is corrected too rapidly. We have used novocain fourteen times in ten patients, and it seems that we can start active motion earlier and in some patients who might never voluntarily use their fixed joints. We have had two complications: one, an effusion into the joint after attempting to flex a knee; the other, an effusion into an elbow as a result of manipulation. Both of these cases recovered spontaneously with preservation of the improved function. As yet, we have not used this technique on enough patients to estimate accurately its value. We feel, however, that the use of novocain may have a definite place in certain patients.

Six hundred twenty-five patients were referred to this section from 15 January to 1 July 1944; 450 of these patients were Chinese and 175 were Americans. A total of 3,800 treatments was given. We have judged our results purely on the functional return rather than on the individual well-being of the patient. We have noted marked improvement in 64 percent of these patients, some improvement in 22 percent, and no improvement in 14 percent.

#### CONCLUSIONS

1. A department of physiotherapy is essential in any medical installation treating patients for more than primary treatment.

2. A physiotherapy department can be organized and equipment built from material obtainable in any camp.

3. Personnel can be trained by any medical officer interested in this type of work.

4. Novocain injections may be of value locally in treatment of some of these cases.

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**Shock.**—During the past three years an enormous amount of investigation on the subject of shock has added materially to our knowledge. One fact, however, remains clear: There is no single reliable test or clinical sign of impending shock, especially in anesthetic and postanesthetic states. By the time shock is recognized as such, it is well established. Our ability to treat shock has improved, but it is far from satisfactory. The earlier the treatment is instituted the better the results, and if its advent is anticipated it may be prevented far easier than it may be cured. Though there are no positive early tests of impending shock, there is a large background of clinical observation from which to deduce that shock will appear under certain circumstances—burns involving 20 percent or more of the body surface, severe dehydration, multiple fractures and wounds, crushing injuries, exposure to cold air or immersion in cold water, and extensive blood loss. It is well known that shock develops more readily with a given injury if there exists malnutrition or starvation, anemia, dehydration, physical or mental exhaustion, chronic illness, or prolonged bed rest. With these facts available, one should be able to anticipate and usually prevent shock in the surgery in civilian hospitals. (Coller, F. A., Crook, C. E., and Job, Vivian: Blood Loss in Surgical Operations, J.A.M.A., 126:1-5, 2 September 1944)

## Cleft Palate Prosthesis

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Dental Corps, Army of the United States

CAPTAIN THEODORE KATZ

Dental Corps, Army of the United States

In a routine dental examination a soldier, 24 years old, was found to have a congenital complete cleft palate and a right lateral cleft lip. Otherwise he was in good health. The lip had been repaired when he was an infant. When he was 16, the hard palate was closed by operation. A small opening remained in the right lateral region, at the junction of the os incisivum and palatal portion of the maxillary bone. A cleft also extended in the median line from about the mesial of the second molars, through the uvula. The teeth were in good condition. The upper right lateral and left second bicuspid were missing. He had a class III malocclusion which was not severe. Guttural speech was present, but he could be understood. He had an inferiority complex.

### TREATMENT

The cleft was to be closed by means of a "pin-lock hinge" obturator. A movable velum was planned because the musculature of the soft palate was flexible and sufficient palatopharyngeal muscles remained to envelop the artificial velum and swing it posteriorly. With a suitable perforated tray, a snap impression of the hard palate was taken with red impression compound to position the tray and give a definite seat for the final impression. The snap impression was removed, chilled, and the excess trimmed  $\frac{1}{4}$  inch away from the teeth and cleft. The surface of the compound was flamed and the colloid material added to the tray for the final impression. The posterior portion of the tray was brought into position first, and the tray was then seated so that the impression material was forced upward into the cleft area. Seating the posterior portion first prevents an excess of the material from escaping into the pharyngeal region and also gives a good impression of the lateral borders of the cleft. An impression of the lower teeth was taken at this time. Models were poured, mounted, and used for study.

It was decided to clasp the upper left bicuspid and molar and the upper right bicuspid and first molar. The necessary places for rests were cut into the respective teeth. A final im-

pression was then taken for the working model, using the technique previously described (figure 1).

The cleft on the cast was filled in with base-plate wax and made to conform with the remaining lateral wings of the palate so that a normal contour was given to the roof of the cast.

A trial base plate was constructed and contoured so that a fingerlike projection extended into the cleft area (figure 2). This was checked in the mouth until the posterior end approximated the junction of the would-be hard and soft palate. The lateral portion of the base plate that extended into the cleft area completed the contour between the lateral portions of the



FIGURE 1. Working model.



FIGURE 2. Trial base plate with projection into cleft area.

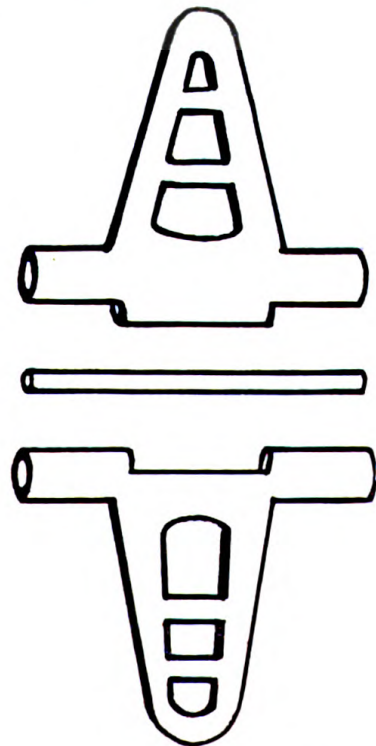


FIGURE 3. "Pin-lock hinge," showing pin and male and female parts.

defect. A "pin-lock hinge" (18-gage tube) was waxed and cast at the post dental laboratory using a hard inlay gold (figure 3). The female portion of the "pin-lock hinge" was embedded in the base plate projection and checked in the mouth. The angulation of this part permitted the male portion of the hinge to swing freely in order to simulate the movements of the velum-palati (figure 4a).

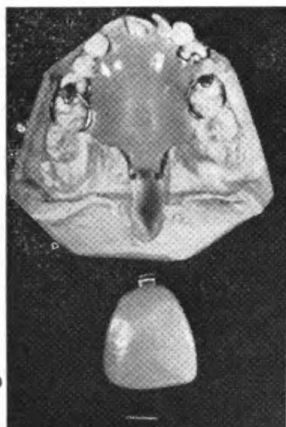


FIGURE 4a. Completed case on model, showing position of female portion of hinge.



FIGURE 4b. Completed case. Inferior view.

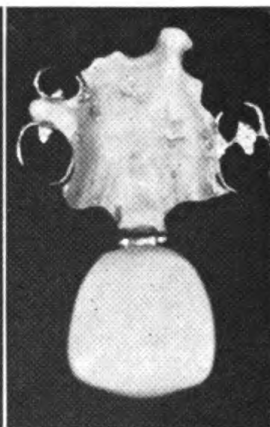


FIGURE 4c. Completed case. Superior view.

The case was assembled on the model. Cast clasps and rests were used on the abutment teeth. The replacements were waxed into position and the entire case given a final try-in. The palatal portion of the obturator was now processed in acrylic and inserted. The case was adjusted and the patient was permitted to wear this part for three days (figure 5).

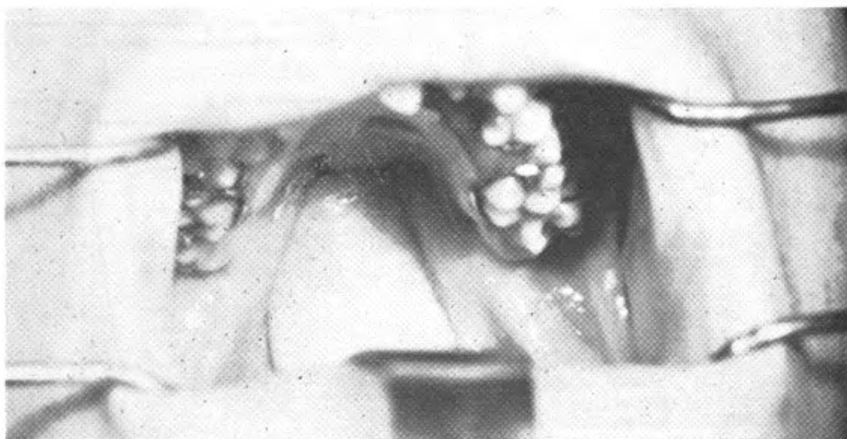


FIGURE 5. Completed case in mouth, showing position of velum.



We were now ready to complete the velum. The male portion of the hinge was attached to the female portion. A small piece of pink wax was molded to the male part and shaped so that it widened out posteriorly with the palatopharyngeal tissues overlapping the edges of the lateral borders.

The velum was contoured so that when it was raised by the musculature in swallowing, it touched the posterior wall of the pharynx at Passavant's bar,\* thus entirely closing off the nasopharynx from the oropharynx.<sup>1</sup>

The velum was contoured by having the patient place his head forward on his chest, hold his head on his right shoulder and left shoulder, and swallow in all three positions. The patient was also instructed to swallow with his mouth open. These swallowing movements caused the palatopharyngeal muscles to envelop the artificial velum and swing it posteriorly. The lateral and posterior borders of the velum were traced with low fusing wax. Final contour was determined by reviewing the various head positions while the patient swallowed. He also was allowed to gargle and speak with the velum in position.

The case was removed and the borders of the velum were traced with a low fusing wax. The swallowing exercises were repeated for a final contour. The velum was chilled before it was removed by having the patient gargle with cold water. It was now removed, processed in acrylic (figures 4b and c), and inserted (figure 5).

Within two weeks after the obturator was inserted the patient could eat and speak without being aware of the appliance.

Elementary speech lessons were begun and an improvement in resonance was noticeable. The speech defect was still present but the patient could be more easily understood.

#### CONCLUSIONS

1. From a prosthetic point of view we were successful in closing a cleft palate and creating an artificial velum which could control the opening between the naso- and oropharynx.

2. Speech resonance and enunciation were improved by a "pin-lock hinge" obturator prosthesis.

3. The morale of a soldier was improved.

\*The American Illustrated Medical Dictionary defines Passavant's bar as a "cross-roll" which appears on the posterior wall of the pharynx during speech in a person with cleft palate. It is caused by contraction of muscle fibers (palatopharyngeal sphincter).

1. Olinger, N. A., Singer, L. E., and Katz, Theodore: A Psychiatric and Surgical Prosthetic Study of a Cleft Palate Patient, Dental Items of Interest. 63:828-839, Sept. 1941.

**Second Hospital for Prisoners of War.**—The second general hospital in the United States to be designated for the exclusive care of wounded German prisoners of war has been established at Camp Forrest, Tennessee. All types of cases will be admitted and treatment will be given by captured German medical officers and enlisted medical soldiers, working under the supervision of a small staff of American medical officers. The first general hospital established for this purpose was the Glennan General Hospital, Okmulgee, Oklahoma, which has been in operation for several months.



# Spontaneous Hemopneumothorax

## Report of Case

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and

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Medical Corps, Army of the United States

Spontaneous hemopneumothorax was first described by Pitt<sup>1</sup> in 1900. Hopkins<sup>2</sup> compiled all cases reported up to 1937 and added three of his own cases. Forty-five cases of spontaneous hemopneumothorax are found in this survey, after the reports which do not conform with our definition are excluded. Since then 14 additional case reports have appeared in the literature.

### CASE REPORT

A nineteen-year-old soldier was admitted to the hospital on 4 August 1943, because of chest pain of several hours' duration. Except for an appendectomy in 1936, he had been well until the day before admission when he felt tired and complained of headache, nasal discharge, and dry cough. The following day, he developed a persistent, dull, aching pain in the left side of his chest, aggravated by deep breathing. Strapping of the chest brought no relief. A few hours later, the pain suddenly became sharp and he was short of breath for several minutes.

Physical examination revealed an acutely ill patient of asthenic build, moderately dyspneic but not cyanotic. His temperature was 100.6° F., pulse 96, respirations 22, and blood pressure 130/85. The trachea was displaced to the right. The left side of the chest did not move with respiration. There was dullness over the left chest posteriorly and when the patient was recumbent, hyperresonance anteriorly. Over the entire left chest, breath sounds were absent, and voice and tactile fremitus were diminished. The cardiac dullness and the heart sounds were found to the right of the sternum. No heart sounds were heard to the left of the median line. The cardiac impulse was visible and palpable in the fifth intercostal space in the right parasternal line.

The blood count was 4,800,000 red blood cells with 92 percent hemoglobin, and 7,400 white blood cells with 72 percent polymorphonuclear cells, 8 percent staff cells, and 20 percent lymphocytes. A moderate poi-

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Accepted for publication on 4 January 1944.

1. Pitt, G. N.: *Case of Rapidly Fatal Haemopneumothorax Apparently Due to the Rupture of an Emphysematous Bulla*, *Clinical Society's Transactions*, London, 33:95, 1900.

2. Hopkins, Henry U.: *Spontaneous Hemopneumothorax*, *Am. J. M. Sc.*, 193: 763-772, June 1937.

kilocytosis and anisocytosis with microcytes predominating were present. Five days after admission, bleeding and coagulation times were normal. The sedimentation rate was 94 mm. in one hour and 105 mm. at the end of two hours.

An x-ray film taken at the bedside showed mediastinal displacement to the right, marked depression of the left dome of the diaphragm and a homogeneous obscuration of the left side of the chest. No parenchymal structure could be identified. The left lung was almost completely collapsed. The film was taken with the patient recumbent and no fluid level could be seen. Nevertheless, the radiologist interpreted the picture as

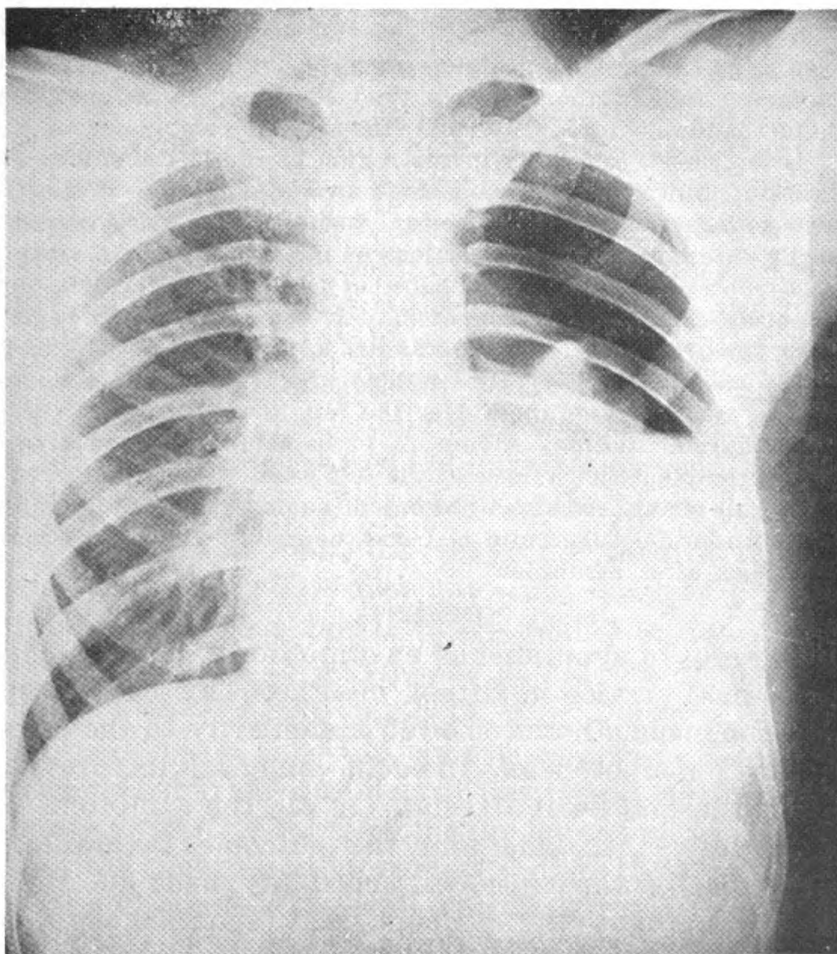


FIGURE 1. Following thoracentesis, with patient upright, hemopneumothorax with a fluid level at left third rib anteriorly. The partially collapsed left lung is visible above the fluid level.

hydropneumothorax, since a pleural effusion massive enough to produce such displacement of the mediastinal structures would have caused a density greater than was seen on the left side.

Because of increasing dyspnea and pulse rate a thoracentesis was done on 6 August, two days after admission. A great deal of air and about 300

Photograph by U. S. Army Signal Corps.

cc. of pure blood were removed. The patient improved and his dyspnea was believed. Because of recurrent dyspnea, the aspiration was repeated twice; 350 cc. of blood were obtained on 7 August, and 600 cc. on 8 August. Each time the blood was sterile and contained many degenerated erythrocytes. It did not clot. After the last thoracentesis, an x-ray film obtained with the patient sitting upright (figure 1), revealed a persistent hemopneumothorax on the left side with a fluid level at the left third rib anteriorly. There was less mediastinal displacement than on the previous film. The partially collapsed left lung was visible above the fluid level.

A week later, the fluid level was one interspace higher, considerable re-expansion of the left lung was noted on the film, and the temperature, which had ranged between 99° and 102° F., began to decline. On 23 August, an x-ray film showed complete re-expansion of the left upper lobe while the lower half of the left lung field continued to be obscured by heavy fluid shadows. On 5 September, the patient complained of a dull ache in his left chest, especially in the region of the left shoulder blade, on inspiration. Dullness was still present over the left lower chest, but the breath sounds came through better, and a pleural friction rub was heard in the anterior and lateral portions of the left chest. An x-ray film taken on 6 September showed that most of the fluid in the left pleural space had disappeared. The outline of the left dome of the diaphragm was distorted by pleural adhesions. There was no evidence of parenchymal disease. The chest pain gradually subsided, the friction rub disappeared after a week, and slight dullness over the left lower chest was the only remaining abnormal finding. A film on 17 September showed a further regression of the pleuritic changes at the left base. The patient's red and white blood cell counts remained normal throughout his stay in the hospital. An intradermal tuberculin test was negative. He was discharged fifty-seven days after admission.

#### COMMENT

Seven cases of spontaneous pneumothorax have been seen on this medical service in fifteen months. This case of spontaneous hemopneumothorax showed a similarity to the cases of spontaneous pneumothorax. In each, young adults, previously in good health, had been affected. In all, the symptoms have been essentially the same and the outcome favorable. In neither disease has the cause, with certainty, been determined. All this strengthens the concept that spontaneous hemopneumothorax is not a separate entity, but a complication of spontaneous pneumothorax.

Hemopneumothorax occurs mostly in young adults. The oldest patient reported in the literature was 45, the youngest 17. Among all patients, there was only one female, reported by Hopkins.<sup>2</sup> In frequency, there was no significant difference in the side of the chest affected; of the 58 cases in which the side was mentioned, the lesion was found twenty-seven times on the right side, and thirty-one times on the left side.

The cause of the disease is not known. The importance of tuberculosis as an etiological factor is debatable. Of all the cases reported, nine had an associated tuberculosis or "probable tuberculosis" either at the time of the occurrence or later, but in none of these was it proved that the tuberculosis was the cause of the hemopneumothorax. The escape of air into the pleural cavity may be explained by the rupture of an emphysematous bleb, air cyst, or subpleural vesicle. The onset is often preceded by an upper respiratory infection, and conceivably the attendant coughing and sneezing may cause a bleb to rupture. In many cases, however, there is no history of preceding illness, effort or strain which would cause a rise in intrapulmonic pressure with a consequent "blowout." Moreover, the rupture of a bleb does not account for the hemorrhage. Hopkins considers the tearing of adhesions, subsequent to the rupture of a bleb, as the most likely cause of the bleeding. According to Matson,<sup>3</sup> the adhesions are supplied from the chest wall by collaterals of the intercostal vessels. Hartzell<sup>4</sup> points out that collapse of the lung should not stop bleeding from adhesions, whereas it should exert a hemostatic effect on bleeding from blebs on the surface of the lungs.

Postmortem examinations have not thrown light on the question of etiology. Of seven autopsies reported in the literature, emphysematous bullae were found in four, and torn adhesions in two of these, but the actual site of bleeding was not demonstrated in any of them.

In many cases reported, and it was true in our case, the blood removed from the pleural cavity did not clot. Pagenstacher, quoted by Pitt,<sup>1</sup> explains the lack of clotting by assuming that the pleura has properties similar to those of the vascular endothelium. Tannenbaum<sup>5</sup> found that fluid from a clear pleural effusion, added to fresh uncitrated blood, prevented the blood from clotting, and therefore concluded that pleural fluid contains anticoagulants. He believes that in hemopneumothorax the pleura reacts to the escaping blood with an effusion which prevents clotting.

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3. Matson, R. C.: Intrapleural Pneumolysis Severing Adhesions in Artificial Pneumothorax, in Goldberg's Clinical Tuberculosis, p. D-128, Ed. II, 1939.

4. Hartzell, Homer C.: Spontaneous Hemopneumothorax: Report of Three Cases and Review of Literature, *Ann. Int. M.*, 17:496-510, Sept. 1942.

5. Tannenbaum, Morris: Spontaneous Hemopneumothorax, with Report of Case, *Dis. Chest*, 8:178-182, June 1942.

The symptoms of spontaneous hemopneumothorax are those of pneumothorax plus bleeding. The onset is usually sudden with sharp pain in the chest where it may be localized or whence it may spread to the abdomen, simulating an acute surgical condition. In Rolleston's<sup>6</sup> case, the onset was characterized by diarrhea and abdominal pain and was followed after twenty-four hours by sudden pain in the right hypochondriac region, radiating to the right shoulder and the umbilicus. Fischer's<sup>7</sup> case was mistaken for a ruptured duodenal ulcer, but a laparotomy failed to reveal any pathological findings in the abdomen. Milhorat<sup>8</sup> reported a case in which the abdominal signs simulated an acute surgical condition. Louria<sup>9</sup> points out that the abdominal rigidity in these cases is due to irritation by the blood on the diaphragmatic pleura with spasm of the rectus abdominis muscles.

Hopkins<sup>2</sup> mentions a second attack of chest pain, from a few hours to several days after the first attack. The first episode probably corresponds to the onset of the pneumothorax, the second, to the tearing of adhesions. The degree of associated dyspnea depends on the rapidity with which the hemopneumothorax develops.

Should the x-ray early reveal a very large collection of fluid, a hemopneumothorax may be suspected. The presence of blood is proved by aspiration. In differentiating this condition from carcinoma or tuberculosis involving the pleura, it should be remembered that in most instances these produce blood-stained effusions rather than blood. The erythrocyte sedimentation rate appears to be accelerated, as was observed in our case. Snively, Shuman, and Snively<sup>10</sup> found in their patient a direct correlation between the sedimentation rate and the amount of blood present in the pleural cavity. The temperature may be elevated in the beginning, and may remain elevated until the blood is resorbed. In the course of this latter process, a pleural friction rub may be heard.

6. Rolleston, H. D.: A Case of Fatal Haemopneumothorax of Unexplained Origin, *Clinical Society's Transactions*, London, 33:90, 1900.

7. Fischer, B.: Der gutartige Spontanpneumothorax durch Ruptur von Spitzennarbenblasen, *Zschr. klin. Med.*, 95:1, 1922.

8. Milhorat, A. T.: A Case of Spontaneous Hemopneumothorax (with Some Simulation of an Acute Surgical Abdominal Condition), *Am. J. Surg.*, 13: 315-317, Aug. 1931.

9. Louria, Milton R.: Spontaneous Hemopneumothorax with Report of Five Cases and One Autopsy, *J. Bull. Sea View Hosp.*, N. Y., 4:44-58, Oct. 1938.

10. Snively, D., Shuman, H., and Snively, W. D.: Spontaneous Hemopneumothorax; Report of a Case, *Ann. Int. M.*, 161:349-356, Feb. 1942.



Most patients recover, usually with the formation of pleural adhesions. Eight of the reported cases were fatal. Death was usually the result of hemorrhage.

Too little is known about the late results of the patients who recovered; but no recurrence has been recorded. Milhorat<sup>11</sup> who re-examined his patient six and one-half years after the episode, found thickening and areas of calcification of the pleura on the side of the previous hemopneumothorax. Clinically, the patient was in excellent health.

Treatment consists of therapy for shock, if present, and the relief of dyspnea. For the latter, the administration of oxygen may be sufficient; but in cases with marked mediastinal shift, it will be necessary to aspirate. In many of the reported cases, the practice has been to replace the aspirated blood by air in order to prevent further bleeding. However, it seems to us that the injection of air is contraindicated when the aspiration is necessitated by dyspnea and mediastinal shift.

With a large amount of blood in the pleural cavity, it is tempting to remove it by repeated aspirations. But the danger of infection should be borne in mind. Moreover, Hopkins,<sup>2</sup> surveying the literature, found that patients subjected to repeated thoracenteses did not make a better recovery than those not aspirated. It is therefore advisable to treat the patients conservatively and let clinical judgment decide if and when a thoracentesis should be performed.

#### SUMMARY

1. Despite lack of anatomical proof, the rupture of an emphysematous bleb and the subsequent tearing of pleural adhesions are considered as the most likely cause of spontaneous hemopneumothorax.

2. The leading symptoms are sudden chest pain and a varying degree of dyspnea.

3. The physical findings are those of hydropneumothorax. Since evidence of bleeding may be absent, thoracentesis will usually be necessary to establish the diagnosis.

4. The disease usually runs a favorable course resulting in absorption of the blood and air. Treatment should therefore be conservative. Thoracentesis should be performed only for diagnosis and for the relief of dyspnea.

11. Milhorat, A. T.: Spontaneous Hemopneumothorax. Report of a Six and One-half Year Follow-up of a Case, *Am. Rev. Tuberc.*, 35:106-108, Jan. 1937.

## Prevention of Angulation in Lower Third Humeral Fractures

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and

CAPTAIN JAMES W. RILEY

Medical Corps, Army of the United States

Varus deformity at the fracture site was encountered in sixteen of twenty-four unselected cases of fractures of the lower third of the humerus seen at Ashford General Hospital. This deformity was associated with a degree of disability in rough proportion to the amount of deformity present. It has been pointed out<sup>1 2 3</sup> that to avoid this deformity the forearm must be immobilized in pronation. The effectiveness of pronation in correcting this deformity is indicated in figures 1a and 1b.

An analogy can be drawn between the situation present after fracture of the lower third of the humerus and the characteristic pronation contracture of the forearm seen in cerebral spastic paralysis. Muscle spasticity exists in each case and the more powerful pronating group overcomes the supinators. Regardless of the plane in which the palm is immobilized, the anatomical relation of the bones of the forearm tends to remain that of pronation. Thus, bringing the palm toward the supine position produces progressive lateral deviation of the distal fragment and results in the characteristic deformity.

The model shown here illustrates the mechanics of this fracture. A simulated fracture was made in the lower third of the humerus. The upper fragment was mounted in a stable position on an upright; the lower fragment with attached forearm, elbow fixed at right angles, was mounted on a flat surface with a hinge which permitted motion of the distal portion of the extremity at the fracture site in either sideward direction. Equally strong rubber bands on the medial and lateral aspects bridge the fracture site to lend stability to the model. A third rubber band, which arises from the humerus just above the medial condyle and is inserted on the ulnar aspect of the radius in its middle third, represents the difference in power between the pronators and supinators in which spasm has been induced by trauma. In figure 2a, with the third rubber band detached and the palm in the supine position, the align-

1. Bohler, Lorenze: *The Treatment of Fractures*, 4th English ed., pp. 190-196. Baltimore: William Wood and Company, 1935.

2. Griswold, R. A., Goldberg, H., and Joplin, R.: *Fractures of Humerus*, *Am. J. Surg.*, 43:31-38, January 1939.

3. Key, J. A., and Conwell, H. E.: *The Management of Fractures, Dislocations, and Sprains*, 3d ed., pp. 598-609. St. Louis: C. V. Mosby Co., 1942.

ment of the fragments is good. In figure 2b the rubber band has been attached as indicated; the palm is in the prone position, and the alignment remains good. However, in figure 2c with the rubber band remaining in place, the palm has been brought into the supine position and lateral deviation of the distal fragment is clearly shown.

We feel that fractures through the lower third of the humerus should be treated by immobilizing the hand and forearm in full pronation to prevent lateral bowing of the distal humeral fragment.

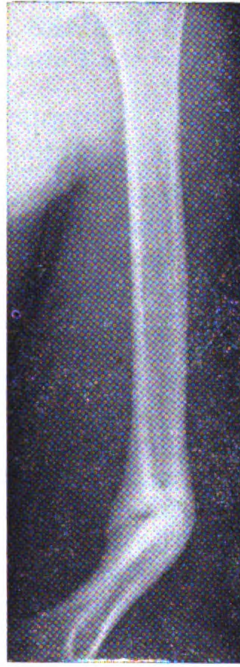


FIGURE 1a. Fracture united at 45-degree angle. Immobilized with hand in supination.

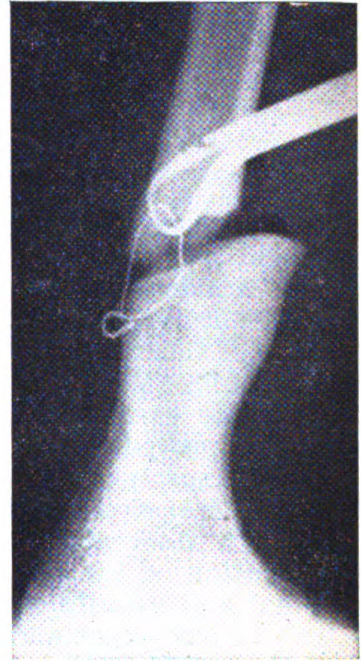


FIGURE 1b. Same fracture after osteotomy with hand in pronation. Wire through cortex to prevent distraction.

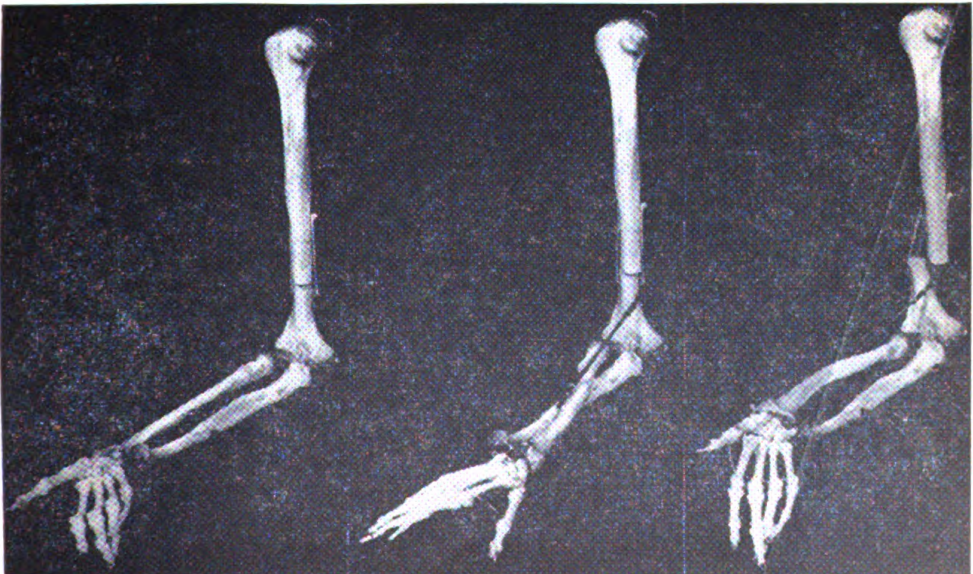


FIGURE 2a. Rubber band representing pronator predominance detached. Hand in supination. Alignment not disturbed.

FIGURE 2b. Rubber band representing pronator predominance now in place. Alignment maintained with palm prone.

FIGURE 2c. Same as 2b, except palm now supine. Lateral deviation of distal fragment.



# Demonstration of Hidden Apical Chest Lesions

CAPTAIN H. E. BASS

Medical Corps, Army of the United States  
and

MAJOR SAMUEL I. KOOPERSTEIN

Medical Corps, Army of the United States

The lower annual hospital admission rates for tuberculosis in World War II as compared to those in World War I have been due to universal x-ray examination of inductees. A transient rise of admissions occurred early in the current mobilization because of inexperience of induction station personnel with mass x-ray examinations. Certain cases undoubtedly also eluded detection in the early months when x-ray examination was not a universal procedure in induction stations.

Fortunately many of the cases inducted into the service through error are detected promptly and are hospitalized. Some cases with tuberculous lesions elude detection because of the type and location of the lesion. These lesions for the most part are minimal and usually exudative or exudative-productive in character. In our experience the majority of such lesions have been near the apex of the lung. A number of these were obscured by the first rib or clavicle and we believe that accounted for some

errors in chest x-ray screening at the time of induction. These lesions, most of which were tuberculous and could not be visualized in the usual postero-anterior projection, were invariably discovered by means of the lordotic x-ray film. It was felt that emphasis should again be laid on the importance of the lordotic position in the demonstration of hidden apical chest lesions.

The posterior lordotic position has been found to be of greatest use. As described by Sante,<sup>1</sup> the x-ray tube is tilted so that the

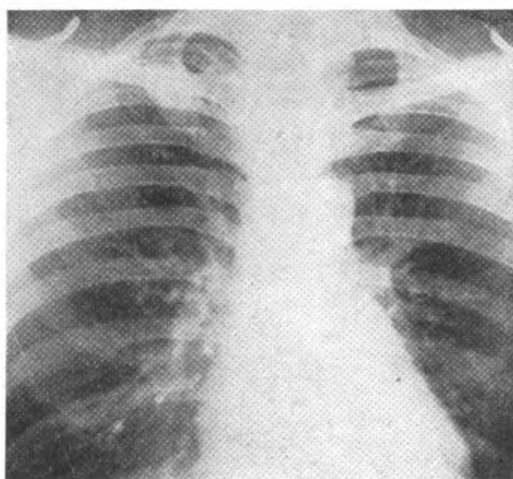


FIGURE 1. Induction x-ray of chest. Increased density at the level of the right clavicle and first rib.

principal ray is projected horizontally, centered on a 14- by 17-inch cassette supported by a vertical film-holder which has

From the Medical Service, Bruns General Hospital, Santa Fe, New Mexico.  
1. Sante, L. R.: *Manual of Roentgenological Technique*, 9th revised edition. Ann Arbor, Michigan: Edwards Brothers, Inc., 1942.

been adjusted to the proper height for the patient. The patient stands with his back to the cassette, hands on hips, shoulders squarely against the cassette holder, feet about one foot forward, knees slightly bent, and abdomen protruding in a position of extreme lordosis.

#### CASE REPORT

A corporal, 38 years of age, was admitted to the hospital on 16 August 1943. He gave no history of tuberculosis in his family. For five years previous to induction, he had worked as an attendant in various hospitals. He had been an attendant for eighteen months on the tuberculosis wards of a large general hospital.

When he was inducted into the Army on 30 October 1942, the x-ray was considered negative. In August 1943, after ten months' service, he was assigned as an attendant on the tuberculosis ward of this hospital. During routine Mantoux testing of ward personnel, he showed a highly positive Mantoux test. A routine chest x-ray revealed a questionable density obscured by the right clavicle. The original x-ray film taken at the time of induction was obtained and showed the same questionable lesion obscured by the right clavicle. The appearance of the induction film (figure 1) and the routine P. A. projection was identical. A lordotic x-ray demonstrated a large well-circumscribed lesion having the appearance of the so-called round pulmonary focus of tuberculosis (figure 2).

#### DISCUSSION

In the lordotic x-ray film, there is a marked foreshortening of the lung fields, so the apical-diaphragmatic measurement is

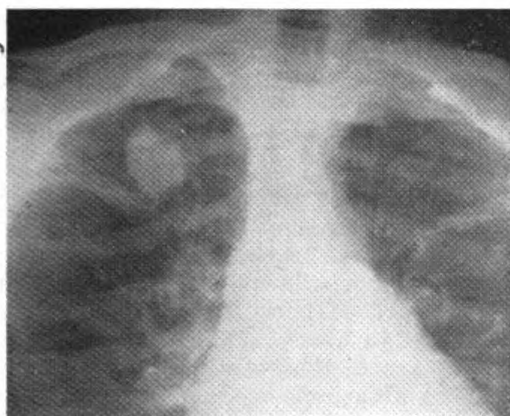


FIGURE 2. Lordotic x-ray of chest reveals a round pulmonary nodule which was obscured by the clavicle and first rib in the P. A. view.

decreased. The clavicles are thrown upward completely out of the pulmonary fields. The ribs pursue a horizontal course. The cardiac silhouette is likewise distorted and appears shortened and widened. Frequently one is astonished at the extent of the pulmonary lesion brought into view by this maneuver. These abnormal shadows likewise undergo some distortion and may appear somewhat larger than their actual size, as illustrated in figure 2.

The factor of rotation must be considered. Lesions in the anterior portion of the apex will be thrown upward, those in the posterior portion will be projected downward, while those in mid-antero-posterior position will not be influenced by rotation and will not show any change in position. The position of the nodule in the mid-lung field, as demonstrated in figure 2, indicates that no rotation occurred.



# Arteriovenous Aneurysm

## Report of Unusual Case

LIEUT. COLONEL DANIEL C. ELKIN\*

Medical Corps, Army of the United States

The incidence of vascular injuries in this war will probably surpass that of any other. In addition to the usual wounds produced by machine-gun and rifle bullets and high explosive shells, a great many multiple injuries are caused by fragmentation of land mines and grenades. These may produce as many as one hundred small, individual wounds scattered over the body without causing death. It is to be expected that with multiple injuries of this type, more than one aneurysm may be produced. Three patients have been seen at this hospital in whom two aneurysms were present. In the case here reported some fifty small, penetrating wounds, the result of an accidental explosion of a tank grenade, occurred on the posterior thighs, legs, buttocks, and right hand, producing three arteriovenous fistulas; one involved the left posterior tibial vessels, and two involved the right posterior tibial vessels. The case is reported because of its rarity and in order to point out the necessity of careful examination if these lesions are not to be overlooked.

### CASE REPORT

The patient received some fifty small, penetrating wounds on 13 November 1943. The wounds were immediately débrided and dressed. All healed slowly without incident. He was transferred to Ashford General Hospital on 22 February 1944, with a diagnosis of arteriovenous aneurysm of both legs.

Examination revealed multiple small, healed wounds over the posterior surface of the lower extremities (figure 1). The blood pressure was 120/76. Cyanosis of both feet was present, most marked on the right. The posterior tibial pulsations could be felt; those of the dorsalis pedis vessels were faint. Over the medial aspect of the middle third of both legs was a continuous thrill and a continuous bruit accentuated in systole. The bruit was transmitted upward to the knees and downward to the soles of the feet. Pulsations as shown by oscillometric determinations were increased in the popliteal and tibial regions. Skin temperatures of the toes were normal but were increased in the region of the aneurysms. There was no drop in the pulse rate on obliteration of the communications by pressure.

On 26 February 1944 an incision was made on the posteromedial aspect of the left leg (figure 2) and the posterior tibial vessels with the fistula were identified just anterior to the soleus muscle. After quadruple ligation and division of the main vessels, the fistula was excised. Numerous tribu-

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From the Vascular Surgery Center, Ashford General Hospital, White Sulphur Springs, West Virginia.

\*Now colonel.

tary collateral vessels were ligated with the extirpation of the fistula. Recovery from this operation was uneventful, and the foot and toes remained warm.

On 1 March 1944 a similar incision was made on the right leg and an arteriovenous fistula excised in a similar manner (figure 2). Recovery from this operation was uneventful, and there was no disturbance in the circulation of the extremity distal to the excised fistula. Following a thirty-day convalescent furlough, he re-entered the hospital on 12 April 1944. Examination then revealed evidence of another arteriovenous fistula in the left posterior tibial vessels about 2 inches above the point of excision of the fistula excised on 26 February 1944.

On 19 April 1944 the third operation was performed, and a



FIGURE 1. Photograph of patient showing multiple wounds and the three incisions.

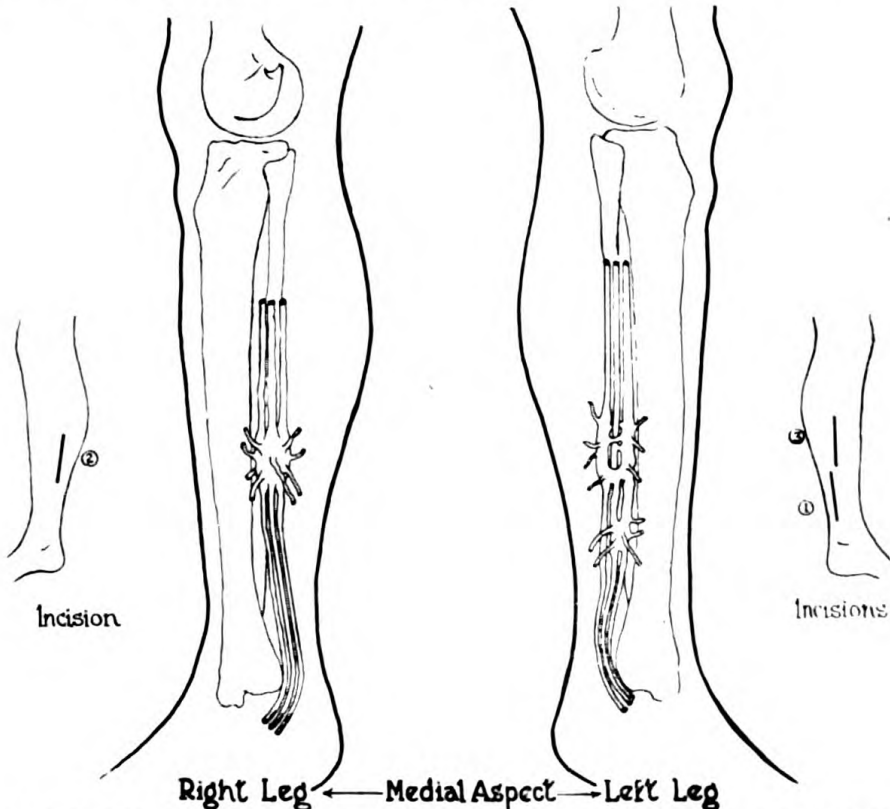


FIGURE 2. Schematic representation of the arteriovenous communications.

definite fistula of the left posterior tibial vessels was found, about 3 inches proximal to the point of ligation for the removal of the previously excised aneurysm (figure 2). Recovery from this operation was uneventful, and circulation in the foot is good.

#### SUMMARY

Three arteriovenous communications, one in the right posterior tibial vessels and two in the left posterior tibial vessels, developed in a soldier as a result of a grenade explosion. This case illustrates the necessity of careful examination of all wounds for the presence of such lesions.

## The Collecting Company in Combat on Pacific Atolls

CAPTAIN DANIEL M. ADAMS

Medical Corps, Army of the United States

The U. S. Army has had to fight on many far-flung fronts with many widely different problems in logistics, training, and tactics. The problems demand the most versatile staff work, the

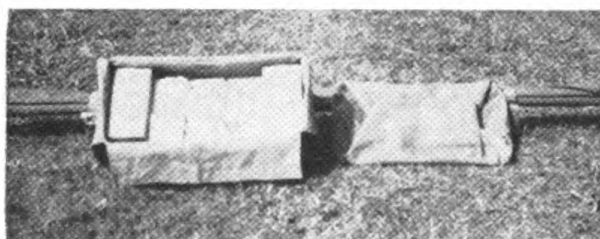


FIGURE 1. Canvas bags, one empty and the other containing two units of plasma.

utmost in originality, and the maximum in effort by everyone. Second echelon evacuation of casualties, which normally is provided by the collecting companies of a medical battalion, has its own peculiar problems in combat in the Central Pacific Area.

Their solution requires the rapid adoption of means and methods that are not found in any standard text.

The tactics involved in warfare on atolls lead one to conclude that the basis for successful 2d echelon evacuation or collecting company function must be in the maximum of mobility and flexibility. The collecting company or platoon must be as mobile as the infantry units it serves, and it must be sufficiently flexible to cover any deficiency in the chain of evacuation which can occur in an action so swift and violent that its outcome may be decided in a matter of hours.

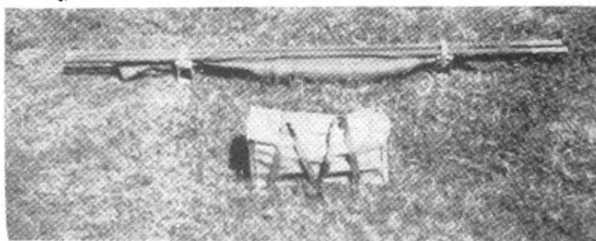


FIGURE 2. The partially filled canvas bag with litter straps attached. In the background is a new-type litter which holds one blanket and a few basswood or wire-ladder splints.



The Medical Department soldier in the collecting company must be as physically fit and as mentally alert as his brother in the infantry; his morale must be high and he must use his own initiative when the occasion demands. The method to these ends is in training similar to that given to infantrymen. The principles of scouting, patrolling, use of map and compass, camouflage and concealment, and individual and small unit security measures are



FIGURE 3. Filled canvas bag slung atop the field pack and attached to the belt by means of litter straps.

of vital importance to the collecting company soldier. His technical training in emergency medical treatment, in the administration of morphine and blood plasma, and in transporting sick and wounded by standard and improvised methods in combat must be as thorough as that of the company aid man and other members of the battalion medical section. Thorough grounding in individual defense of all Medical Department echelons in an assault should be considered necessary.

Familiarity with the personnel, organization, and tactics of the combat team of which he is a part enhances the confidence and aggressive spirit of the collecting company soldier as it does that of the combatant elements. It is as important for him to be thoroughly familiar with all phases of a proposed operation as it is for the infantryman.

The dress of the collecting company soldier, like that of the infantry, should be light and cool but sufficient to give the maximum protection from sun and insects. Leggings in themselves are unnecessary and when wet may contribute to macerations and abrasions of the skin.

The medical pouches may be lengthened and filled accordingly. In specific circumstances one pouch may be used to hold one unit of plasma. Packs should be as light as possible and need contain chiefly a shelter half, change of socks, underclothes, toilet articles, and mess gear, the essential item of which is a spoon. The ideal pack would perhaps be the musette bag with a shelter half

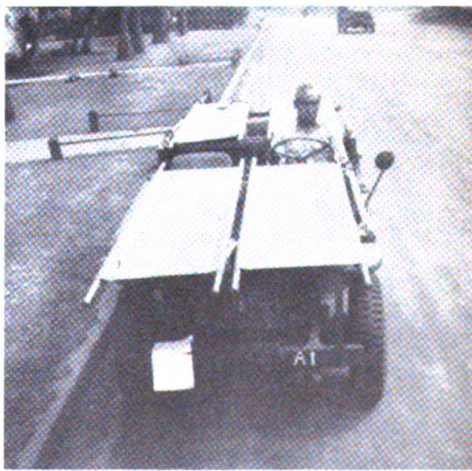


FIGURE 4. The 1/4-ton improvised ambulance with four litters in place.

rolled and superimposed on it. Two full water canteens and salt tablets are necessary.

The essential organizational medical equipment for each platoon can be said to consist initially of M.D. Chest No. 1, M.D. Chest No. 2, the surgical dressing box, and additional plasma as considered advisable. The necessary contents of these chests can be broken down and the contents and the plasma divided into from twelve to twenty-two packs to be carried one pack to a soldier. The pack most useful and usable is a canvas bag, about 10 by 10 by 20 inches. This bag can be carried in the pack carrier or secured with litter straps and carried atop the musette bag; it can also be slung over one shoulder or carried in one hand. Its weight in addition to the contents is negligible. These containers can be made rapidly and cheaply from salvaged cot canvas (figures 1 and 2). In addition to their equipment, as many as eight to ten litters each containing a blanket, Thomas leg and arm splint, and two to four wire ladder or basswood splints can be carried by hand in each platoon. Once ashore, these and the canvas packs can be placed at the station site and used as needed. Vehicular transportation if available may be used for future



FIGURE 5. Transportation of two litter and four sitting patients.



FIGURE 6. Twelve litters carried on the litter rack. With the rear seat removed, the vehicle can transport a large proportion of necessary medical supplies.

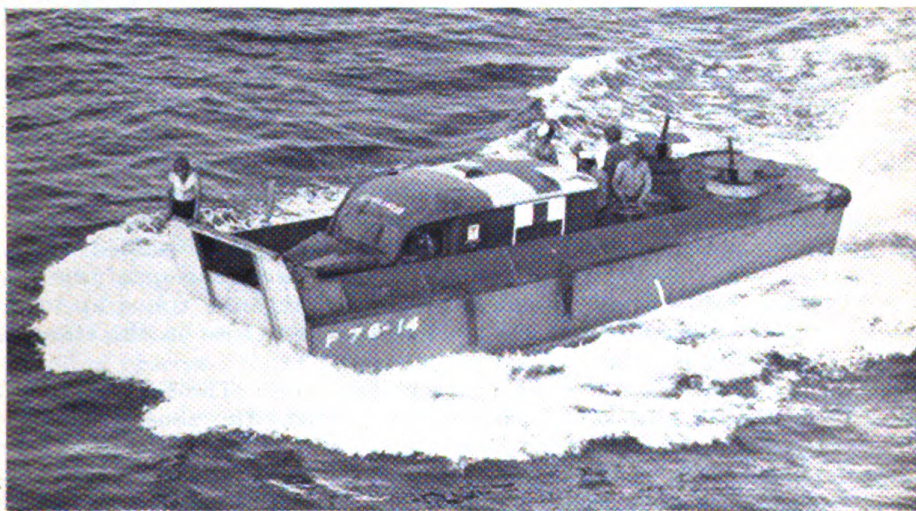
movement of the items; if not, they can be transported manually.

The most valuable aid in evacuation is the  $\frac{1}{4}$ -ton truck. A minimum of two per platoon is necessary wherever they can be used. These trucks can be converted into improvised ambulances with the attachment of a metal frame to act as litter racks (see illustrations) and loaded with extra supplies including litters, prior to embarkation. These supplies may be removed to form a dump on landing, and the truck becomes immediately available for evacuation purposes. Four litter patients can be easily transported at one time or two to three litter patients and two to four sitting. The frame shown is cheaply and easily made from

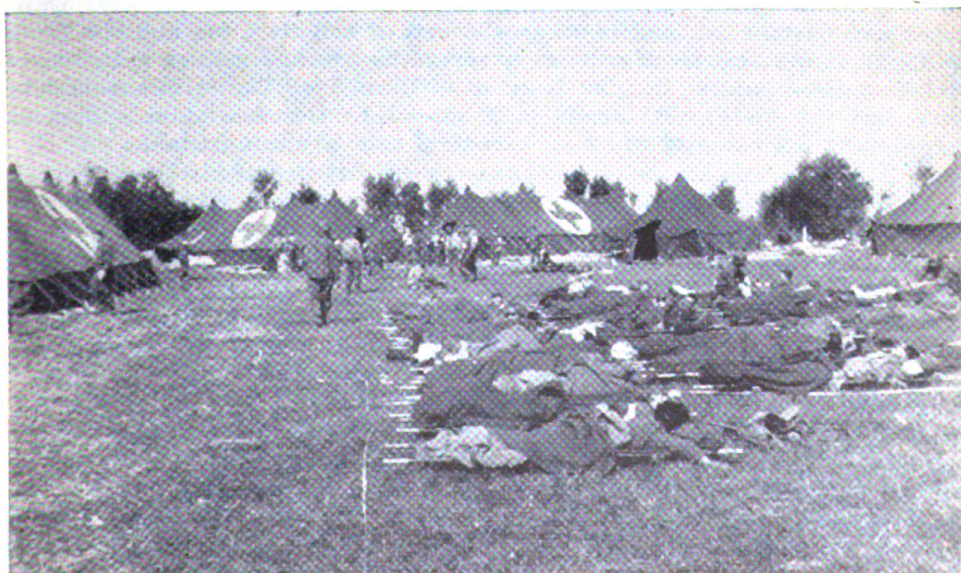


salvaged angle iron, is collapsible, and can be easily applied to the vehicle without major modifications.

In a recent operation where a reef several hundred yards out prevented landing craft coming up to the beach, amphibious vehicles were used to transport casualties to the ships from the collecting station and aid stations adjacent to the beach. This procedure proved ideal for the situation and facilitated the rapid evacuation of casualties. The lessons learned in amphibious operations on coral atolls in the Central Pacific have contributed toward the ideal in 2d echelon casualty evacuation, which is to get them back as quickly and comfortably and in the best condition possible.



A Higgins craft ferrying an ambulance to the beach during invasion of southern France. Seventh Army, 15 August 1944. Signal Corps photograph.



Casualties from initial beachhead landings on Northern coast of France await treatment at a field hospital. 9 June 1944. Signal Corps photograph.

## THE CARE OF SOLDIERS' FEET

CAPTAIN PAUL A. PEMBERTON

Medical Corps, Army of the United States

Certain problems in the care of soldiers' feet are peculiar to men taken from civilian occupations and put through a basic training center. Most of these soldiers with foot complaints should be cared for in the dispensaries without reference to an orthopedist. In this way treatment can be started early and excessive loss of time from training avoided. This paper is addressed, therefore, primarily to the dispensary officers to aid them in determining the disposition to be made at the first examination of these soldiers.

Although medical officers are responsible for the physical welfare of trainees, the comfort of the individual is not our primary motive in treating men with foot complaints; instead, an endeavor is made to keep the greatest number of soldiers on active duty as much of the time as possible. Our responsibility is comparable to that of the coach who at the beginning of the training season must get his men in fighting shape in spite of discomforts, realizing that thereby fewer casualties will occur throughout the season. The ability to predict the ultimate outcome of a soldier whose foot causes symptoms during basic training is of great value. We should be able to tell before beginning a course of treatment whether or not the soldier will be able eventually to continue on full duty. Thus we can avoid excessive waste of time and effort by getting the permanently disabled soldier assigned to limited service or out of the Army. Examination of the feet should be made with both shoes and socks off and trousers rolled up to the knees. Both feet should be examined with the patient first in the standing and then the sitting position.

The tendency is to issue shoes that are too small. The G. I. shoe will furnish support to a normal foot if properly fitted. The shoe size should not be determined entirely by the total length of the foot but also by the distance from the back of the heel to the head of the first metatarsal. The first metatarsophalangeal joint should be at the widest part of the shoe, which is at the flare of the inner border of the sole just in front of the shank. In this way the medial side of the upper will fit like a glove under the longitudinal arch and help support it. In a foot with relatively short toes there may be an inch between the end of the first toe and the front of the shoe, but this is of no consequence. The average soldier will wear a shoe two sizes longer than he wore in civilian life. The width should be such that the metatarsal heads may spread to the maximum extent on weight bearing, but any width in excess of this is uncomfortable.

The soldier should be instructed in the proper care of his shoes. Saddle soap should be rubbed daily into the leather of new shoes until it is pliable. They should be kept dry and polished with a wax polish. Wearing any one pair only on alternate days will allow thorough drying. Trainees should wear wool socks while on duty, and a clean pair should be put on once or twice daily. Two pairs of wool socks will avoid many minor foot disabilities which commonly occur on long marches. The feet should be bathed daily. A hot foot bath after a hard day of training will relieve fatigue. However, the soldier should be warned against soaking the feet in hot water too frequently or too long. A period of fifteen or twenty minutes is adequate. The use of foot powder is sometimes beneficial, and talcum is as good as a medicated powder for routine use.

Disorders of soldiers' feet may be classified into three groups: (1) those in which treatment is not required but may be of benefit in relieving symp-

toms; (2) those in which treatment is necessary and is successful; (3) those in which treatment is unsatisfactory.

#### Mild Foot Strain

The first group comprises normal feet which are subjected to excessive strain. The diagnosis can best be expressed as mild foot strain. The only symptom is pain in the feet and legs on walking and there is not sufficient disability to keep the man from full duty. This occurs in individuals who were not working on their feet all day prior to induction. The symptoms are more severe in obese and short-legged soldiers who must take the same stride as the taller men in the ranks. Pain begins in the first few days of drill and its intensity increases for two to three weeks. By the fourth week the symptoms are subsiding, and at the end of six weeks of training soldiers with normal feet can drill all day or hike twenty miles without pain. In this condition there is neither cramping nor swelling of the feet and legs. Examination shows full range of motion in all joints of the foot and ankle with no pain at the extremes of range of motion. This is the most important diagnostic point in differentiating this from more serious conditions. Moderate tenderness is present over the muscles of the calf, the ligaments of the sole of the foot, and the capsules of the midtarsal joints, but it is never extreme nor well localized. In the leg it is more conspicuous along the medial border of the upper tibia, apparently due to strain at the origin of the tibialis posterior. In the foot, tenderness is usually more marked at the posterior attachment of the plantar fascia and beneath the astragaloscaphoid joint.

Treatment is usually not required in this group. The majority of such inductees never report on sick call but assume it is part of the normal conditioning process. Those who come for relief should be reassured by explaining to them the nature of their complaints and the value of proper foot hygiene. The size and condition of the shoes should be checked. A hot foot bath every night will give relief. The feet should not be taped. Firm taping will support the feet and limit joint motion, thereby giving relief from pain, but the muscles will be permitted to rest instead of being forced to work until they are strong enough to do so without pain. For the same reason, the soldier should not be kept in quarters or on light duty for relief of symptoms, as this would only postpone the time of his complete recovery and he would go through the same thing each time he started on a severe training program. The dispensary surgeon should recognize this syndrome and deal with it without the necessity of referring such patients to the specialist or the hospital.

The second group is the largest and most important class of foot disorders with which the dispensary officer comes in contact. It includes those lesions which result in disability unless properly treated but for which there is a treatment which results in complete recovery.

#### Faulty Foot Posture

The most common condition found is faulty foot posture, usually manifested by pronation of the foot. This is recognized by an outward rotation of the calcaneus with dropping of the inner border of the foot, thus throwing the body weight on the medial side of the foot and resulting in symptoms of strain of the longitudinal arch. The condition is due to relative weakness of the posterior tibialis muscle. There is sometimes an accessory navicular or prominence on the medial border of the navicular with resultant poor attachment of the tibialis posterior. The strain on the medial side of the foot may cause lowering of the longitudinal arch, resulting in one of the several types of flatfoot. Examination usually shows, in addition to pronation of the heel, tenderness beneath the astragaloscaphoid joint, where the patient localizes the pain. There is no swelling and no



limitation of motion. Forcing pronation of the forefoot may cause pain. The diagnosis is strain due to faulty foot posture and treatment is directed toward correction of the pronation. This includes overcoming the excessive lengthening and weakness of the tibialis posterior. Mild cases can be treated satisfactorily with a medial wedge under the heel of the shoe, 3/16 inch thick along the inner border and tapering off over halfway across the heel. The heel of the foot must fit snugly into the shoe.

In more severe cases the inner border of the heel is lifted by an arch support in addition to the wedge. A firm flexible support is used and the high point of the support should come under the sustentaculum tali and lift it up. This must be fitted carefully as there is a tendency to get the high point of the arch too far forward, usually under the navicular. This throws all the weight on the arch support and does not correct the pronation.

In the use of arch supports, the point of highest elevation of the longitudinal support should vary according to the condition for which the appliance is being fitted. There are numerous variations in size, shape, position, and consistency of both longitudinal and metatarsal pads, and they are too complex to be described on a prescription form. The skill required to properly fit supports is beyond the training and ability of a shoe clerk. There is little use for steel arch supports in the Army although they are beneficial in many conditions seen in civilian practice. A foot which requires a rigid support for relief of symptoms will not stand vigorous Army training.

A support made of sole leather with a hard felt longitudinal support and a felt or sponge rubber metatarsal support fastened on its under surface has been found of value. The sole leather should be stiff and of a thickness known as "8 to 9 iron." The felt is listed in the Medical Department Supply Catalog as No. 3760000, Splint accessory felt, wool, white, 1/2 inch thick. The leather is cut to proper shape from a pattern, which can be made up in advance in several sizes, and is then skived along both sides and across the front end. A leather skiver is usually standard equipment in a shoe repair shop. The skiving can be done with a knife or on a sanding drum. The felt is cut to shape, skived with a knife, then finished off on the sanding drum after being glued to the leather. The support is put together with heavy rubber cement (see illustration). The completed arch support may be covered on the under surface with a piece of thin, soft leather known as russet lining splint.

The pronated foot usually will be relieved sufficiently by medial wedges and a proper arch support so the soldier can continue on duty. Treatment should be continued indefinitely; usually two to three months are required to strengthen and shorten the invertors of the foot so that corrective appliances can be discarded.

Special exercises for this condition in soldiers are not advisable as the muscles are already being developed as rapidly as possible by the training program, and if they are allowed to work all day in a mechanically advantageous position the effect is better than with fifteen minutes of specialized isolated muscle exercises.

#### Acute Foot Sprain

Acute sprain is sometimes associated with the chronic strain of poor foot posture, usually within the first two weeks of training or after a long march. In addition to the signs described there is swelling through the mid-tarsal region. Ecchymosis does not occur. This foot will require rest from weight bearing if symptoms are severe. Taping the foot in slight inversion, with a fitted piece of felt under the longitudinal arch, will permit a limited amount of walking. The 1/4-inch firm gray felt (Med. Dept. Item No. 3761000), either one or two thicknesses, is more satisfactory for this purpose

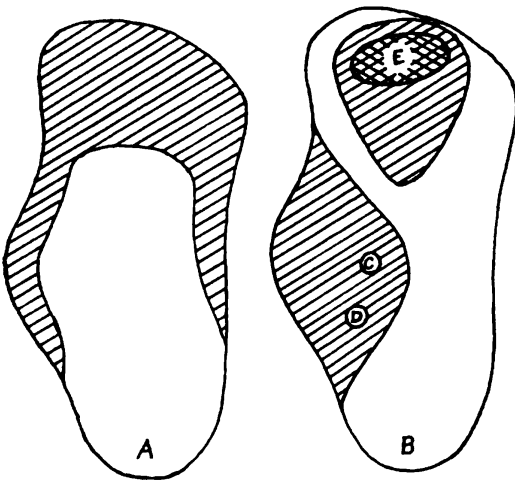
than the harder white felt used for arch supports. When the acute symptoms are relieved, the pronation should be corrected to prevent recurrence.

#### Congenital Weak Foot

A common condition causing complaint in the early stages of training is the congenital weak foot, which is usually long and slender, with thin bones, poor muscles, and relaxed ligaments. Such patients will probably volunteer the information that they have received some benefit from arch supports or special shoes, but there is no consistency in the type of support which has given relief. It varies from an almost shapeless sponge rubber pad to a Whitman plate. The most striking feature of the congenital weak foot is its flexibility, and the increased range of motion in all of the joints. The important thing in treatment of such a foot in the Army is to realize that this soldier will not stand as much training at first and will require a longer period before he is able to keep up with his fellows. However, he can be expected to do full duty eventually. Treatment consists of the use of a flexible arch support and adhesive strapping, the latter being continued over a long period of time and applied in a manner to support any joints showing symptoms of strain. The arch support has the high point of the longitudinal pad under the navicular. The support should be comfortable when first used and no attempt should be made to have it as high as can be tolerated, as is done in correcting pronation. The support may have to be continued permanently. A new sponge rubber arch support soon to be available in the Army will be of value in the treatment of weak feet.

#### Metatarsalgia

A group of cases which can be classed together only because of similarity in treatment is characterized chiefly by the symptom of metatarsalgia. The pain under the heads of the second, third, and fourth metatarsals is commonly associated with pronated feet and weak feet. There may be a short first metatarsal, apparent drooping of the middle metatarsal heads with a thick callous underneath, or mild pes cavus. Treatment consists of properly fitting a metatarsal pad of felt or firm sponge rubber. This is either glued to the inside of the shoe or is fastened to an insole which can be inserted into any shoe. The pad must be high enough, wide enough, and properly placed so that weight is borne on the shaft of the metatarsal and not on the head.



Details of construction of the flexible arch support. "A" shows the pattern of the sole leather. The shaded area indicates the amount of the edge which is to be skived. The front end of the support is thinned out to allow it to conform to the metatarsal pad. "B" shows the usual shape and location of the longitudinal and metatarsal pads. "C" is the highest part of the arch when this is to come under the navicular. "D" is the highest point of support when this is to come under the sustentaculum tali as in the pronated foot. The darker shaded portion at "E" is the usual location of the highest part of the metatarsal pad.

#### Congenital Flatfoot

Congenital flatfoot is commonly seen in the dispensary particularly among Negroes. Its principal importance to the dispensary surgeon is to determine the extent of disability, if any. This patient gives a history of having always had flat feet. Examination shows a perfectly flat



foot, normal range of motion in all of the joints, and a straight inner border. Such a foot does not constitute a disability, is probably no more subject to strain than what is commonly considered to be a normal foot, and should *not* be fitted with an arch support. The difficulty usually encountered with this type of foot is due to the fact that it is encased in a shoe which was made for a foot with an arch in it. In civilian life this man probably wore a cheap shoe which broke down as soon as he stepped on it; so he had no difficulty. The problem can be solved by giving him a shoe of sufficient width through the shank.

This type of foot is subject to certain changes which must be recognized, as they constitute disabilities. If there is any swelling of the foot on walking, any limitation of joint motion, or a bulging of the medial side of the foot, the soldier will probably never be able to do full military duty. The bulging is the head of the talus which is twisted medially and downward, resulting in poor articulation with the navicular and associated with a valgus of the entire forefoot. There is no satisfactory treatment for this condition, as the Army is no place for radical surgery for flat feet.

#### Flat Feet in the Army

There has been a tendency to consider *pes planus* as a pathologic entity of serious import. Our experience indicates that flat feet are no more likely to be symptomatic than feet with a demonstrable longitudinal arch. A flat foot is subject to strain in the same manner as other feet and thus may become painful, but relief depends on successful treatment of the strain and not of the flatfoot.

There is no indication for classifying *pes planus* according to degree. The following classification is made only to show that the relation between the various degrees of flat feet and the true anatomic or pathologic condition of the feet is of no importance.

1. *Pronated foot* is the foot with faulty posture. It is usually considered a flat foot by the patient and frequently so diagnosed by the physician. Actually, if the pronation of the heel is corrected, it will be seen that a normal longitudinal arch is present. Discussion of the recognition and treatment of this type of foot is given under the subject of faulty foot posture.

2. *Low arch in an otherwise normal foot.* The normal longitudinal arch varies from the high arch approaching that of a mild *pes cavus* to the complete absence of an arch in the congenital flat foot. The relatively low arch is commonly classed as flatfoot of first or second degree. However, this foot is not symptomatic because of the lack of elevation of the arch. It is subject to the same disorders as any normal foot and if it becomes painful should be treated according to the pathology present, and not simply as a low arch. Diagnosis of this type of foot is made chiefly by exclusion of pronated foot and weak foot in a foot with a relatively low arch and no other obvious abnormalities.

3. *Congenital weak foot* might be considered as the only flat foot in which the symptoms present are related to the sagging of the arch, and which can be relieved by replacement of the arch. This type of foot is not always markedly flattened and there is no parallel between the degree of the flatness and the severity of the symptoms. The foot is weak; so the muscles cannot hold it up on weight bearing. The joints are flexible and the ligaments are loose and consequently readily subjected to strains if not properly supported on weight bearing. Further discussion of diagnosis and treatment of this condition has already been given.

4. *Congenital flatfoot* is a completely flat foot. If painful, the symptoms are not due to the absence of a longitudinal arch. No attempt should be made to form an arch, as this will only increase the disability.

5. *Spastic flatfoot* is easily recognized by the fixed pronation of the heel, with little or no sub-talar motion, spasm of the peroneals, and absence of x-ray evidence of arthritis. This is usually a serious disability. Treatment requires hospitalization, which may give relief but will not ordinarily result in making the man fit for full duty.

6. *Depression of the transverse arch* is a misnomer. All of the metatarsal heads normally rest on the ground on weight bearing. Because of the differences in the shape of the metatarsals there is a transverse arch present on the plantar surface of the foot behind the metatarsal heads and this varies in height. However, no relation has been noted between variations in the height of this so-called arch and any symptoms in the foot. The symptom of metatarsalgia may result from failure of the proper distribution of the body weight through the metatarsals to the ground either in standing or walking but this is not accompanied by changes in the transverse arch of the forefoot.

#### Minor Foot Injuries

Minor foot injuries are usually not difficult to recognize and treatment is satisfactory. Acute strains or sprains of the feet occur chiefly on the obstacle course in jumping. X-ray should be used to rule out fractures. The injury may involve the plantar fascia or some joint. The foot should be taped to support the injured part and, if there is any swelling, should be relieved from weight bearing by a few days in quarters. Tenosynovitis occurs frequently in the heel cord, the anterior tibial, and the extensors of the toes. Taping in a position which shortens the affected tendon will relieve the pain; rest for a few days in quarters may be necessary. A thick felt pad under the heel will relieve the pain of Achilles' tenosynovitis. The back of the shoe should be softened by rubbing in saddle soap. The painful bursa, or exostosis and bursa combined, on the dorsum of the foot usually can be relieved by the wearing of longer shoes and if necessary a soft felt pad under the tongue of the shoe.

#### March Fracture

In march fracture, there is a history of rapid onset of pain in one forefoot. The pain may not be disabling and the soldier may continue to take long hikes, but the discomfort is continuous on weight bearing and becomes increasingly severe. Examination always shows soft tissue swelling and localized tenderness. The swelling may be firm and localized over the shaft of the second, third, or fourth metatarsal, or it may be soft and involve the whole forefoot. The swelling is felt on both the dorsum and the plantar surfaces of the foot. The tenderness is over the site of the fracture along the shaft of one of the central metatarsals. There may be ecchymosis.

With such findings, the patient should be hospitalized as a suspected march fracture. Diagnosis of this injury should not depend on x-rays. There may be three weeks between the onset of symptoms and the first x-ray evidence of a fracture.

When the patient is discharged from the hospital, his shoes should be checked. Soldiers suffering from march fracture have usually been wearing shoes which are too short.

#### Posttraumatic Adhesions

A painful foot may follow some injury such as fracture, sprain, crushing injury, or trauma which caused prolonged swelling of the foot. The injury may have been anywhere from the hip downward with adhesions which limit joint motion and are painful when attempt is made to force motion in the joint. The diagnosis is made on the history of injury and the limitation of motion, with absence of clinical and roentgenologic evidence of arthritis. Manipulative therapy is more successful in this type of foot

problem than in any other. If the foot is too stiff and appears to be bound down by firm bands around the joints, little improvement can be expected and this patient should be placed on limited duty or discharged. The manipulation should accomplish as much stretching and as little tearing as possible. It is done gently under general anesthesia in the hospital. All joints are put through a full range of motion even if it requires two or three manipulations. The patient is up on his feet the next day and the foot is kept active. He may be returned to duty within ten days. If there is any swelling, ecchymosis, or other evidence of severe reaction in the foot, the treatment was too harsh and may do more harm than good. Treatment should not be repeated sooner than three weeks.

#### Plantar Warts

While plantar warts constitute real disabilities, they can usually be relieved by repeated treatments with local applications of chemical cauterizing agents. If a chiropodist is available for the dispensary, these patients may be turned over to him. If the lesion is extensive, the patient should be transferred to a general hospital for x-ray therapy.

#### Convalescent Foot Care

Special attention should be called to a condition due to the lack of proper care of the feet of a patient who has been confined to the hospital. It is common practice for this man to be on his feet in the hospital area for varying periods before returning to duty. Foot strain may result, due to wearing canvas slippers, prolonged bed rest, or weakness associated with the original illness. All patients confined to bed for prolonged periods should have proper support for their feet as soon as they are out of bed. This means shoes should be worn as soon as the patient gets on his feet, and arch supports of the type described for weak feet should be fitted if necessary.

#### Permanently Disabling Foot Problems

Medical men are accustomed to being gratified if after treatment of difficult cases they accomplish a degree of improvement which under the circumstances is the best to be expected. However, in treating foot problems which existed prior to induction and which result in disability early in training, any success short of perfection is a failure. Included in this class are such more or less permanent disabilities as pes cavus, hallux valgus, spastic flatfoot, arthritic foot, either posttraumatic, gonorrheal, or part of a generalized arthritic syndrome, paralytic foot, congenital deformity, and multiple congenital hyperkeratosis.

Pes cavus, recognized by the unusually high arch and drooping metatarsal heads, can sometimes be treated satisfactorily. The symptoms are usually those of strain of the longitudinal arch and metatarsalgia. An attempt is made to redistribute the weight over as much of the surface of the foot as possible. This is done with a high, firm arch support with the highest point of the longitudinal pad under the navicular, and a high, wide metatarsal pad which will tend to elevate the heads of all five metatarsals. In our experience the metatarsal bar under the shoe has been of little use on the stiff sole of a G. I. shoe.

The treatment of hallux valgus is unsatisfactory. Either it is sufficiently mild to require no specific treatment or it is associated with other mechanical defects which cause strain and remain even after successful correction of the valgus deformity. If treatment of the associated foot strain and fitting with proper shoes do not give relief, correction of hallux valgus probably will not result in a foot that can stand the stress of full military duty. The same can be said of most cases of arthritic feet. It is important to recognize such a foot when it is first seen. There is a history of recurrent episodes of stiff, painful, swollen feet; there may be an

apparent etiologic factor, such as injury, onset during an attack of gonorrheal urethritis, or typical history or findings of generalized arthritis. This soldier will be seen during the first few weeks of training. Characteristic findings are limitation of joint motion and pain at the extremes of the range of motion. In the absence of other demonstrable causes this should be considered arthritis. Tenderness, swelling, local heat, fluid in the joint, characteristic x-ray changes, and increased sedimentation rate may be present. Once the joints of a foot have been damaged by arthritis, the prognosis for full military duty is extremely poor.

The majority of the cases of multiple congenital painful hyperkeratoses seen have been in Negroes. These are characterized by thick tender callouses over the sides and back of the heel, along the medial side of the first metatarsophalangeal joint and the great toe, under the metatarsal heads, and at any other points of continuous irritation on weight bearing. Treatment has been unsatisfactory and it is believed that this disqualifies a man for full military service.

#### Conclusion

There is nothing peculiar or mysterious about the examination and treatment of foot problems. The foot is made up of the same fundamental anatomic structures as the rest of the skeletal system, and these are subject to the same disabling factors of disease and injury. The treatment of disabilities of the feet is carried out according to established principles of orthopedic surgery.

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### BRONCHIAL ASTHMA DUE TO SULFATHIAZOLE

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The sensitizing properties of sulfathiazole have been definitely established by contributions to medical literature. Various types of sulfathiazole eruptions were reviewed by Shaffer and his associates.<sup>1</sup> Systemic and dermatologic reactions due to sulfathiazole sensitization were reported by Livingood and Pillsbury.<sup>2</sup> A case of angioneurotic edema as a manifestation of sulfathiazole reaction was reported by Dennie.<sup>3</sup> The allergic potentialities of this drug have been emphasized also by Lyons and Balberor.<sup>4</sup>

Toxic reactions following sulfathiazole therapy have been reviewed by Dowling and Lepper.<sup>5</sup> These complications must be differentiated from allergic manifestations of hypersensitiveness.

A search of the available literature failed to reveal any mention of bronchial asthma due to sulfathiazole sensitivity. This observation may have been reported by other physicians, but its implication is so important that our observations seem worthy of mention.

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Captain Herbert M. McDonald, M.C., made the diagnosis in this case.

1. Shaffer, B., Lentz, J. W., and McGuire, J. A.: Sulfathiazole Eruptions: Sensitivity Induced by Local Therapy and Elicited by Oral Medication. Report of Four Cases with Some Allergic Studies, *J. A. M. A.*, 123:17, 4 Sept. 1943.

2. Livingood, C. S., and Pillsbury, D. M.: Sulfathiazole in Eczematous Pyoderma: Sensitization Reaction to Successive Local and Oral Therapy; Report of Twelve Cases, *J. A. M. A.*, 121:406-408, 6 Feb. 1943.

3. Dennie, Charles C.: Angioneurotic Edema and Dermatitis Venenata-like Lesions Due to the Oral Administration of Sulfathiazole, *J. A. M. A.*, 120:197, 19 Sept. 1942.

4. Lyons, R. H., and Balberor, H.: Febrile Reactions Accompanying the Readministration of Sulfathiazole, *J. A. M. A.*, 118:955-958, 21 March 1942.

5. Dowling, H. F., and Lepper, M. H.: Toxic Reactions Following Therapy with Sulfapyridine, Sulfathiazole, and Sulfadiazine, *J. A. M. A.*, 121:1190, 10 April 1943.

### Report of Case

A soldier, aged 37, was admitted to the station hospital on 3 November 1943 for treatment of gonorrhea. He was first treated for an acute urethritis, 16 September 1943, three days after contact. Gram-negative intracellular diplococci were found on smear. He was given 1 gm. of sulfathiazole orally 4 times a day for five days. After five days this procedure was repeated with no control of the urethral discharge or symptoms.

On admission to the hospital the gonococcus was present on smear and was isolated from the prostatic secretion. He was then given 1 gm. of sulfathiazole orally every four hours. After eight days' treatment (a total of 32 gm.) the patient developed an intensely pruritic and generalized type of giant urticaria affecting the neck, abdomen, and upper extremities. Two hours later he developed simultaneously swellings of the face, lower eyelids with partial closure of both eyes, and a marked swelling of the dorsum of the left hand. The ocular and palpebral conjunctivas were injected.

As the urticarial lesions subsided, the patient became dyspneic with pronounced wheezing and bouts of dry cough. Examination of the lungs showed typical wheezy, musical rales throughout. On admission the lungs were clear and resonant. Sulfathiazole determination of the blood four hours after the onset of the asthmatic symptoms showed a trace. The blood count was 4,940,000 red cells per cubic millimeter, and 9,400 white cells, and the hemoglobin was 13.8 gm. The differential count showed neutrophils 66 percent, lymphocytes 27 percent, eosinophils 3 percent, and monocytes 4 percent. Several urine examinations were negative. The nonprotein nitrogen of the blood serum was 39 mg. per 100 cc. The blood Hinton reaction was normal. An x-ray film of the chest taken during the height of the asthmatic seizure was negative.

The patient became increasingly dyspneic and for the first time (14 November) since the onset of the reaction, 5 minims of epinephrine hydrochloride, 1:1,000 solution, were given subcutaneously. This dose was repeated every half hour for a total of 20 minims. There was a complete disappearance of all symptoms within twenty-four hours except for scattered wheezy, sonorous rales at the bases, which persisted for ten days.

### Allergic Studies

The patient denied any personal or family history of hay fever, asthma, urticaria, or other manifestations of allergy. He had successfully completed his basic training, including marches and hikes. Skin tests on 25 November 1943 were negative to all common inhalants and animal danders except for a 1-plus reaction to chicken feathers. Skin tests for all foods of Army diet were negative. Patch tests with 5 and 20 percent sulfathiazole ointment and sulfathiazole powder were negative after twenty-four hours. However, an intradermal injection of 0.1 cc. of 0.2 percent sulfathiazole solution gave a 4-plus reaction within twenty minutes. An intradermal injection of 0.1 cc. of an isotonic solution of sodium chloride used as a control was negative. This procedure was repeated on other areas of the arm at various intervals with the same results.

Passive transfer tests performed in the manner outlined by Shaffer and his associates<sup>1</sup> on a normal individual showed a 4-plus reaction to the testing solution (0.2 percent sulfathiazole) only on the sensitized areas. Similar tests on the normal areas or tests with isotonic sodium chloride solution on the sensitized areas were negative.

Since admission to the ward the patient was allowed to use a pillow containing chicken feathers to rule out this sensitivity as a cause of his symptoms.



Five days after the skin tests the patient was given 0.5 gm. of sulfathiazole orally. When this dose was repeated four hours later, he again developed signs of clinical asthma associated with a moderate conjunctivitis bilaterally. His chest cleared without medication within twenty-four hours. Blood determination done at this time still showed a trace of sulfathiazole.

The patient remained free from symptoms or clinical signs of bronchial asthma, and he was discharged to duty on 14 December 1943. All prostatic smears examined after his allergic reaction remained negative for gonococcus.

#### Comment

Since this case was brought to our attention we found scattered wheezy, musical rales in 1 of 3 other cases of angioneurotic edema due to sulfathiazole. As other writers<sup>6</sup> have pointed out, sulfathiazole has been in use too short a time to scientifically appraise its dangerous allergic potentialities. The bronchial mucosa once sensitized to sulfathiazole may by its lowered threshold also react to other allergens to produce asthma in an otherwise normal individual.

A warning must again be heralded to physicians who are using this drug for gargles, nasal and throat sprays, intratracheal instillations, bronchial asthma or status asthmaticus in which there is some secondary infection. Sulfathiazole must be used judiciously when indicated, with the full realization that the patient's life may some day depend on his ability to tolerate its readministration.

#### Conclusions

The bronchial mucosa may become sensitized to sulfathiazole to produce the symptoms of bronchial asthma. The allergic potentialities of this drug are again emphasized.

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### MODIFIED MAXILLARY FRACTURE SPLINT

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The acrylic or cast splittype splint, as well as the continuous loop wiring, has produced excellent results in the treatment of fractured jaws. However, conditions arise which do not lend themselves readily to these routine procedures of reduction and fixation. It is then necessary to modify the splint, to get the desired results.

The following case had to be treated by a modified splint. The anterior maxillary plate had been fractured and the right central incisor, right lateral incisor, and right cuspid teeth, still attached to the buccal wall, were driven labially. The fracture lines were vertical between both central incisors as well as between the left cuspid and first premolar. The segment remained attached at its base, being displaced arcwise labially and upward. The horizontal base of the fracture extended across the apices of the three teeth involved.

The complement of the teeth was perfect, but a very definite overbite was present. The incisal edges of the lower six anterior teeth occluded just at the lingual gingival margins of the upper anteriors. The facial aspect of the lower anteriors came in contact with the lingual surfaces of

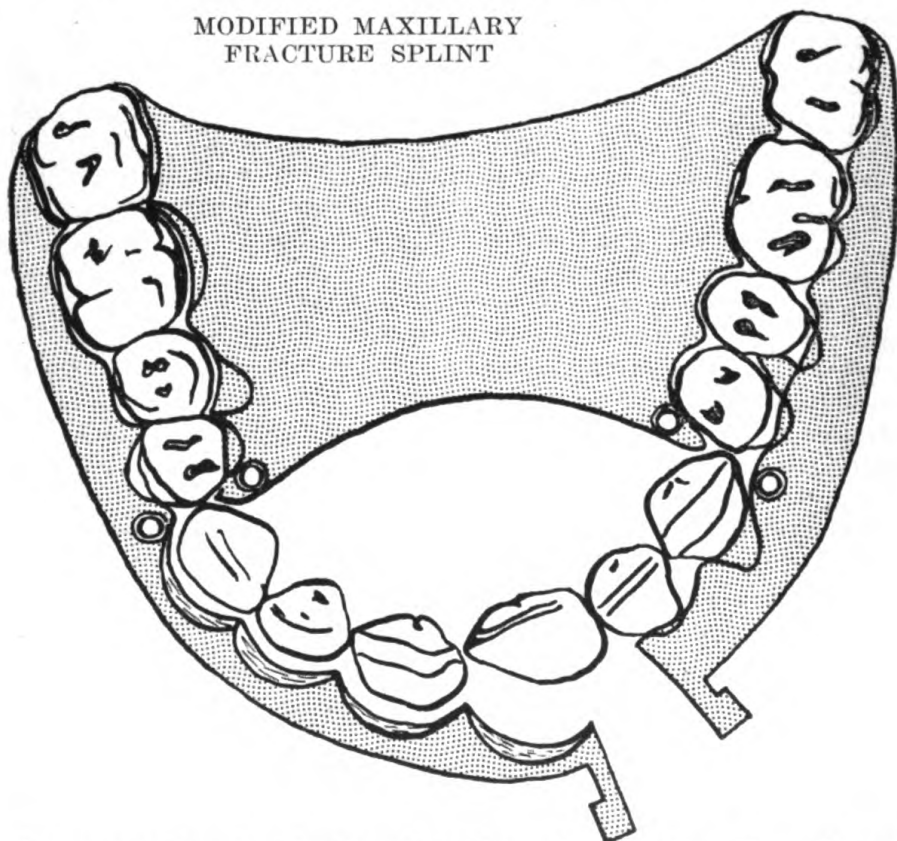
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6. Cohen, M. H., Thomas, H. B., and Kalisch, A. C.: Hypersensitivity Produced by the Topical Application of Sulfathiazole, *J. A. M. A.*, 121:408-411, 6 Feb. 1943.

the opposing upper teeth. Because the bite was close, it would have been impossible to use any wiring procedure. For the same reason, a standard splint could not be used.

The following modified splint was used successfully in this case and can be used to great advantage in similar cases. Impressions were taken and a set of models poured. A duplicate was made of the upper model. This was then cut at the fracture lines and the segment with the displaced buccal wall and three teeth was adjusted to the pre-fracture position. Articulation and buccal alignment of the models permitted this arrangement. From this reconstructed model, the acrylic splint was constructed.

MODIFIED MAXILLARY  
FRACTURE SPLINT



Fracture reduced and splint in position for fixation. Note clasp wire openings for interproximal tie wires between cuspid and first premolar.

The model was waxed on the palatal aspect, up to the mesial of both first premolars, and carried across so that the anterior aspect of the splint in the rugae region was cleared when the lower teeth were occluded. The splint was further outlined on the buccal aspect so that the labial arms would open between the left central and left lateral incisor. This created a longer left buccal arm. At the terminal point of the splint, in the palatal mesial first right and left premolar embrasure, a small eyelet of clasp wire was embedded into the waxed-up model before processing. A similar eyelet was placed on the inferior border of the buccal arms, at the corresponding embrasure points. This would later permit openings for interproximal wiring.

The completed splint, when inserted, was first secured by wire ties running through the metal loops. Anteriorly, the buccal arms were brought

together by a small elastic band over the split "button." The displaced segment had been reduced prior to splint insertion. Subsequently, the rubber band was replaced by a stainless steel wire tie.

The advantages of this modification of the standard constructed maxillary splint are: (1) Close bite cases can be fixed after reduction without resorting to an open bite appliance. (2) Close bite cases which cannot be treated by continuous loop wiring can be splinted readily.

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### TRAUMATIC NEUROPATHY OF BRACHIAL PLEXUS IN PARATROOPERS

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It is well known in civilian practice that certain neuropathies result from repeated trauma of an unusual nature; for example, paralysis of the long thoracic nerve in hod carriers may result from pressure over the shoulder near the base of the neck. Recognition of these entities can save a great deal of time necessary for a clinical investigation of obscure symptoms. It is believed that such a factor is operating among some paratroopers. Five cases were seen in the outpatient dispensary and wards of an overseas general hospital, all members of paratroop organizations and all complaining of paresthesias of the digits of one hand. Two patients also had weakness of the fingers. The symptoms had been disregarded for several weeks, but finally the patients presented themselves at sick call.

#### Case Reports

CASE 1. A 25-year-old private who had made twelve practice jumps, several with full field equipment, complained of persistent tingling and a "numb" feeling in the fourth and fifth digits of the right hand for two or three weeks. The general physical examination was negative. Neurological examination revealed an area of diminished sensation for touch, pain, and temperature over the fifth finger, ulnar half of the fourth digit, and the hypothenar border of the hand. No appreciable weakness of finger movements was present. The radial pulses were equal. No cervical rib could be seen by x-ray examination. Maneuvers for eliciting signs of scalenus anticus pressure were negative. All laboratory examinations were normal. The patient's personality make-up appeared to be stable. His symptoms were disappearing when last seen about five weeks from date of initial examination.

CASE 2. A 24-year-old sergeant had made twenty-five practice jumps and one jump in combat. He had noticed "numbness" of the right fifth digit for five weeks prior to reporting on sick call. This was worse in cold weather. He was in excellent physical condition. Neurological examination revealed a mild sensory disturbance of the right fifth digit and the ulnar border of the hand. There was some weakness of adduction of the fifth digit. The right pupil was slightly smaller than the left but both reacted normally. No evidence of a cervical rib or scalenus anticus syndrome was present. Laboratory examinations were all normal. His personality was a stable one, and there had been no dietary restrictions. He was given physiotherapy for two weeks and reported improvement when last seen.

CASE 3. A 30-year-old private had noticed a mild "tingling" of the fifth digit of his left hand after his tenth practice jump. Five days after a combat jump with full field equipment he noticed severe discomfort in the fourth and fifth digits of the left hand consisting of "numbness" and painful paresthesias. He remained in combat and was not seen until three weeks later when his unit had been relieved and sent back to a rest camp. At this time, in addition to sensory disturbance in the ulnar aspect of the

hand, a glove anesthesia of the left hand and many anxiety features were found. The rest of the examination was negative. It was felt that a psychoneurotic reaction had been superimposed on the original injury, and this patient had to be taken out of the paratroops for reassignment.

CASE 4. A 33-year-old first lieutenant had made twenty-nine parachute jumps including two combat jumps when he noticed pain and "tingling" sensations in the first three fingers of the right hand for a month. His physical condition was excellent. Slight weakness of abduction of the thumb and a diminished radial reflex on the right side were present, but no sensory disturbance could be outlined. All x-ray and laboratory studies were negative. The diet was normal. His attitude did not have a neurotic pattern. Physiotherapy was begun, but the patient moved with his unit and no follow-up reports were available.

CASE 5. A 22-year-old private was evacuated from the combat zone in France because of pain, paresthesias, and sensitivity to pressure in the fourth and fifth fingers of the left hand. In July 1943, during his third practice jump his left arm was caught in a shroud line and jerked upward by the opening shock. In a few hours pain and "numbness" in the fourth and fifth digits of the left hand developed. Because of persistent pain, a transposition of the ulnar nerve at the elbow had been done in September 1943 with marked relief of symptoms. Following a combat jump in France about ten months later, there was an acute recurrence of his symptoms, but he remained in combat and took part in a second air-borne operation before being evacuated. Examination revealed marked diminution of sensation for pain, touch, and temperature in the fifth digit and the ulnar half of the fourth digit of the left hand, with extension of the area of sensory disturbance over the ulnar aspect of the hand and lower third of the forearm. Slight weakness of finger adduction also was present. Two small painful nodules were palpable in the region of the operative scar. Surgical re-exploration of the operative site is being considered and no follow-up report is available.

These patients were all from different companies. In all but one, neurotic gain from the symptoms appeared to be a minimal factor if present at all. The mechanism suggested for this syndrome is a mild brachial plexus injury incurred in the opening shock of the parachute just after the jumper leaves the plane. Few paratroopers can remember exactly what takes place immediately after leaving the plane nor the exact position of the body at the time of the opening shock. Only one patient was able to give specific details of an injury incurred prior to the onset of symptoms. Various types of sudden twists and strains can be incurred by the sudden pull of the "risers" attaching the chute to the body harness, if the body is in any but a vertical position at the time of the opening. Sudden upward jerking of the shoulders is reported by some. Others have noticed contusions over the anterior surface of the shoulders on landing, probably incurred by the snapping of the "riser" against the shoulder on the opening shock. The harness is arranged so the axilla does not take any of the opening shock except under abnormal conditions. Sudden upward strains on the shoulder would make the lower trunk or medial cord, if not the lower spinal roots themselves, susceptible to stretching injuries. This is further borne out by the predominance of symptoms in the ulnar distribution of the hand.

The injuries incurred are probably minimal and reversible. It is felt that these patients should not be taken from duty status nor subjected to tedious work-ups which would tend to add a psychological factor to the symptoms. Physiotherapy, reassurance, and a short rest period from actual jumping seem to be the only therapy indicated.